

# MONITORING PROGRAM ANNUAL REPORT

## JANUARY - DECEMBER 2006

### ANCHORAGE WATER AND WASTEWATER UTILITY JOHN M. ASPLUND WATER POLLUTION CONTROL FACILITY AT POINT WORONZOF



Prepared for:



MUNICIPALITY OF ANCHORAGE  
Anchorage Water & Wastewater Utility  
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February 2007

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**NPDES Permit AK-002255-1**

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## **PREFACE**

This document is the Monitoring Program Annual Report required for submittal to the Environmental Protection Agency by NPDES Permit AK-002255-1 for discharge from the John M. Asplund Water Pollution Control Facility, operated by the Municipality of Anchorage at Point Woronzof. The NPDES permit incorporates provisions necessitated by a 301(h) waiver from the requirements of secondary treatment.

The elements of the monitoring program are:

- Influent, Effluent, and Sludge Monitoring
  - In-Plant Sampling
  - Toxic Pollutant and Pesticide Sampling
  - Pretreatment Monitoring
  - Whole Effluent Toxicity Monitoring
- Receiving Water Quality Monitoring
  - Plume Dispersion
  - Intertidal Zone Bacteria
- Sediment and Bioaccumulation Monitoring
  - Sediment Analyses
  - Bioaccumulation Analyses

During 2006, the program consisted of sampling the influent, effluent, and sludge twice for toxic pollutants and pesticides and one receiving water quality sampling. In addition, the Municipality of Anchorage conducted the required self-monitoring program for the influent, effluent, and sludge. Sediment sampling was performed during 2003 and bioaccumulation sampling was performed during 2004. Bioaccumulation sampling had been scheduled for 2003 with the sediment analyses, but insufficient intertidal algae concentrations precluded the collection of samples in both 2003 and 2004. To fulfill the Permit objectives and requirements for a bioaccumulation program, it was proposed to EPA to perform a field bioaccumulation program utilizing a resident species from Upper Cook Inlet, the Pacific cod. This alternate study was approved by EPA and conducted in the fall of 2004.

This annual report provides information concerning the monitoring program performed to meet the requirements as set forth in the NPDES permit that became effective on 2 August 2000. The report covers the period of 1 January through 31 December 2006.



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## **SUMMARY**

### **PURPOSE**

This report is submitted in response to requirements of the U.S. Environmental Protection Agency (EPA) and the Alaska Department of Environmental Conservation (ADEC) as outlined in the National Pollutant Discharge Elimination System (NPDES) Permit AK-002255-1 that was signed on 30 June 2000 and became effective on 2 August 2000. This permit authorizes discharge of effluent from the John M. Asplund Water Pollution Control Facility (Asplund WPCF). Wastewater from the Municipality of Anchorage (MOA) is treated at this facility before discharge to the receiving waters of Knik Arm in Cook Inlet, Alaska. The NPDES permit incorporates the requirements necessitated by a 301(h) waiver from secondary treatment and is in compliance with provisions of the Federal Water Pollution Control Act as amended by the Clean Water Act (CWA, 33 U.S.C. §1251 et seq.) and the Water Quality Act of 1987, P.L. 100-4.

### **HISTORY**

In September 1979, the MOA submitted to the EPA a 301(h) secondary treatment waiver application proposing an improved discharge which eliminated chlorination and required the addition of both a 610-meter (m) extension and a 305-m diffuser to the Asplund WPCF outfall. The outfall extension was intended to move the point of discharge beyond the influence of a gyre that was reported to exist off Point Woronzof on a flood tide which was presumed to carry effluent toward shore, causing bacterial contamination of the shoreline.

Further studies were subsequently undertaken to derive design criteria for the outfall improvements. The central issue was to evaluate outfall design alternatives and the chlorination/no chlorination option in relation to a system of eddies that occur on the flood tide. These studies were completed and presented as an Amendment to the Wastewater Facilities Plan for Anchorage, Alaska (CH2M Hill et al., 1985). This amended plan recommended the use of the existing 245-m outfall with the addition of a three-nozzle diffuser. It was shown that chlorination would be required to meet bacterial standards even with an extended outfall and diffuser. Because the same water quality standards could be met by chlorinating and installing an improved diffuser at the end of the existing outfall, there was no need to extend the outfall.

Concurrent with the studies to amend the facilities plan, a revised 301(h) waiver application was submitted to the EPA. After extensive EPA review, public comment, and hearings, the Final Permit Decision was issued and the five-year NPDES permit became effective 16 October 1985 (EPA, 1985a). As required by this permit, a multi-port diffuser was installed in August 1987 prior to the second year of receiving water sampling. Fourteen years of monitoring were performed under the initial NPDES permit.

The MOA submitted an application to renew the 301(h) waiver from secondary treatment in 1990. A more recent application was submitted in 1998 with additional information provided to EPA in 1999. A draft NPDES permit that incorporated the 301(h) waiver was issued in 1999 for public comment. The renewed permit was signed by EPA on 30 June 2000 to become effective on 2 August 2000 for five years. The permit was administratively extended in August 2005 pending a permit renewal decision from EPA. The most recent application for an NPDES permit and 301(h) waiver was submitted in January 2005 and is currently being reviewed by EPA.

## **RECEIVING WATER ENVIRONMENT**

The Asplund WPCF discharges into Knik Arm, a unique body of estuarine water with extremely high tidal fluctuations (up to 11.6 meters [m] with a mean range of 7.89 m at Anchorage; NOAA/NOS, 1995). These fluctuations produce extensive tidal flats, swift tidal currents of 4 - 5 knots, and intense mixing within the Inlet. The water is almost a slurry because of the naturally high suspended sediment concentrations of up to 2500 milligrams/liter (mg/L). This sediment originates from glacial melt waters discharging into Cook Inlet.

Large temperature extremes occur between summer and winter. In the winter, ice can reach thicknesses of 1 - 2 m and consists of broken pieces due to the large tides and currents. Other important factors are the large volume of saline water present in Cook Inlet and mixing by tidal turbulence which allows this volume to be effective in wastewater dilution and assimilation.

## **MONITORING OBJECTIVES**

The monitoring that was conducted during 2006 consisted of two main components: (1) in-plant monitoring of influent, effluent, and sludge, including whole effluent toxicity testing; and (2) receiving water quality monitoring in the vicinity of the discharge and at a control site across Knik Arm. Objectives of the 2006 program are summarized as follows:

### **2006 MONITORING OBJECTIVES**

#### **Influent, Effluent, and Sludge Monitoring**

- determine compliance with the NPDES permit and State of Alaska water quality criteria
- determine effectiveness of the industrial pretreatment program
- aid in assessing the water quality at the discharge point
- characterize toxic substances
- help monitor plant performance
- determine compliance with the regulatory criteria of Section 301(h) of the CWA
- provide data for evaluation of permit re-issuance

#### **Water Quality**

- determine compliance with the NPDES permit and State of Alaska water quality criteria
- aid in assessing the water quality at the discharge point
- determine compliance with the regulatory criteria of Section 301(h) for the CWA
- determine the level of bacterial contamination in nearshore waters
- provide data for evaluation of permit re-issuance

## **MONITORING RESULTS**

As part of its self-monitoring program, the Anchorage Water and Wastewater Utility (AWWU) conducted daily, weekly, and monthly sampling of influent, effluent, and sludge, depending on the parameter measured. In addition, monitoring for toxic pollutants and pesticides was conducted twice during 2006, once in June and once in August. Whole effluent toxicity testing was conducted quarterly, while water quality monitoring near the discharge was performed once

in June. The following summarizes results of this year's monitoring based on the permit requirements:

## **2006 MONITORING RESULTS**

### **Influent, Effluent, and Sludge**

- Met permit objectives and requirements and State of Alaska water quality standards (AWQS) with the exception of fecal coliform and BOD<sub>5</sub>. Results from parameters of particular concern are summarized below.
- MOA's self-monitoring of total residual chlorine (TRC) showed that the daily maximum for TRC in the effluent was met for the entire year.
- The maximum geometric mean of 850 fecal coliform by most probable number technique per 100 milliliters (FC MPN/100 mL) was not exceeded in 2006. Fecal coliform exceeded the monthly criteria "that not more than 10 % of the effluent samples shall exceed 2600 FC MPN/100 mL during any month" in July and October 2006.
- Total aromatic hydrocarbon, total aqueous hydrocarbon, and total ammonia concentrations in the effluent were below their maximum allowable effluent concentrations (MAECs).
- Cyanide and metals concentrations in the effluent never exceeded their MAECs at any time during any of the 2006 sampling events.
- MOA's self-monitoring of pH and TSS showed compliance with regulatory and permit effluent limitations. TSS and BOD<sub>5</sub> were well within the daily, weekly, and monthly criteria for the entire reporting period. Average monthly removals for BOD<sub>5</sub> and TSS of greater than 30 percent (%) are required by the amendment to the Clean Water Act (40 CFR Part 125; Final Rule, 8/9/94). The percent removal rate for both TSS (77 %) and BOD<sub>5</sub> (34 %) exceeded the 30 % limit on an annual basis, however on a monthly basis, BOD<sub>5</sub> was below the 30 % guideline in March at 28 %.
- Concentrations of toxic pollutants and pesticides, including metals and cyanide, in influent and effluent were generally within the established range or lower than values from a national study of secondary treatment plants.
- Toxic pollutant sludge concentrations were found to be very low compared to the limits established under 40 CFR Part 503 and all were within the established range or lower than values from a national study of secondary treatment plants, with all metals falling at or below the typical concentrations and well below 95<sup>th</sup> percentile worst case values.
- Whole effluent toxicity testing conducted quarterly met the permit limitations for chronic toxicity for all species and all sampling events in 2006.

### **Water Quality**

- Little variation among stations was observed for most hydrographic parameters.

- To test the hypothesis that the water quality at the zone of initial dilution (ZID) boundary was not degraded with respect to the water quality at the nearfield and control stations, statistical comparisons were employed. Conventional parameters such as salinity, temperature, TSS, and pH did show statistically significant differences between stations, but these were not ascribed to the outfall. Rather, these have historically been seen when comparing the Point Woronzof region to the slightly different water mass properties across Knik Arm at the control site. No significant differences were seen for dissolved oxygen, turbidity, fecal coliform, or color.
- Fecal coliform concentrations in offshore receiving water samples were found to be very low at all stations. State-specified criteria of a median of 14 FC MPN/100 mL, a geometric mean of 20 FC MPN/100 mL, and of not more than 10 % of the samples exceeding 40 FC MPN/100 mL were met at all receiving water locations. All fecal coliform samples collected from intertidal areas also met water quality criteria.
- Supplemental receiving water quality samples obtained as part of the plume dispersion monitoring indicated that dissolved metals were all below the State site-specific water quality standards. None of the dissolved metals exceeded the site-specific standards at the diffuser or at any other location. Significant differences between the outfall and control stations were seen for dissolved cadmium and copper which was slightly elevated at the outfall. These increased dissolved metals concentrations as compared to controls may be attributed to the outfall, but water quality standards were still met. Total recoverable metals were elevated compared to the dissolved, as expected, and this was attributed to high suspended sediment loads.
- All cyanide concentrations in the receiving waters were below the receiving water quality criterion limit of 1.0 µg/L and no statistically significant differences were detected between concentrations at the control and outfall stations.
- Supplemental receiving water samples also demonstrated that total aromatic hydrocarbons and total aqueous hydrocarbons met the State's water quality standard at all locations. No statistically significant differences were detected between the control and outfall stations for either total aromatic hydrocarbons or total aqueous hydrocarbons.
- Turbidity met the State water quality criteria at all stations. TRC concentrations were below 0.010 mg/L (10 µg/L) at all stations, except two that were located within the ZID, as compared to the AWQS of 2.0 µg/L for salmonid fish and 10.0 µg/L for other marine organisms. As the lowest level detection limit that is achievable for TRC in seawater is higher than the State's most restrictive standard, it cannot be determined if this standard was met at all locations. Color was found to meet State water quality criteria for all samples and locations.

## CONCLUSIONS

Results from this year of the monitoring program confirm previous studies, data in the 301(h) waiver application, and the decision by the EPA to reissue the permit. The Asplund WPCF is operating within regulatory requirements with few exceptions and is showing no significant impacts to the marine environment.



## **1.0 INTRODUCTION**

### **1.1 REGULATORY/ENVIRONMENTAL BACKGROUND**

The monitoring program is designed to meet the requirements of the National Pollutant Discharge Elimination System (NPDES) Permit AK-002255-1 which authorizes discharge of municipal effluent into the Knik Arm of Cook Inlet receiving waters from the John M. Asplund Water Pollution Control Facility (Asplund WPCF), operated by the Municipality of Anchorage (MOA; Figure 1). The NPDES permit, which became effective on 2 August 2000, incorporates the requirements necessitated by a 301(h) secondary treatment waiver and is in compliance with provisions of the Federal Water Pollution Control Act as amended by the Clean Water Act (CWA 33 U.S.C. §1251 et seq.) and the Water Quality Act of 1987, P.L. 100-4.

#### **1.1.1 Regulatory Background**

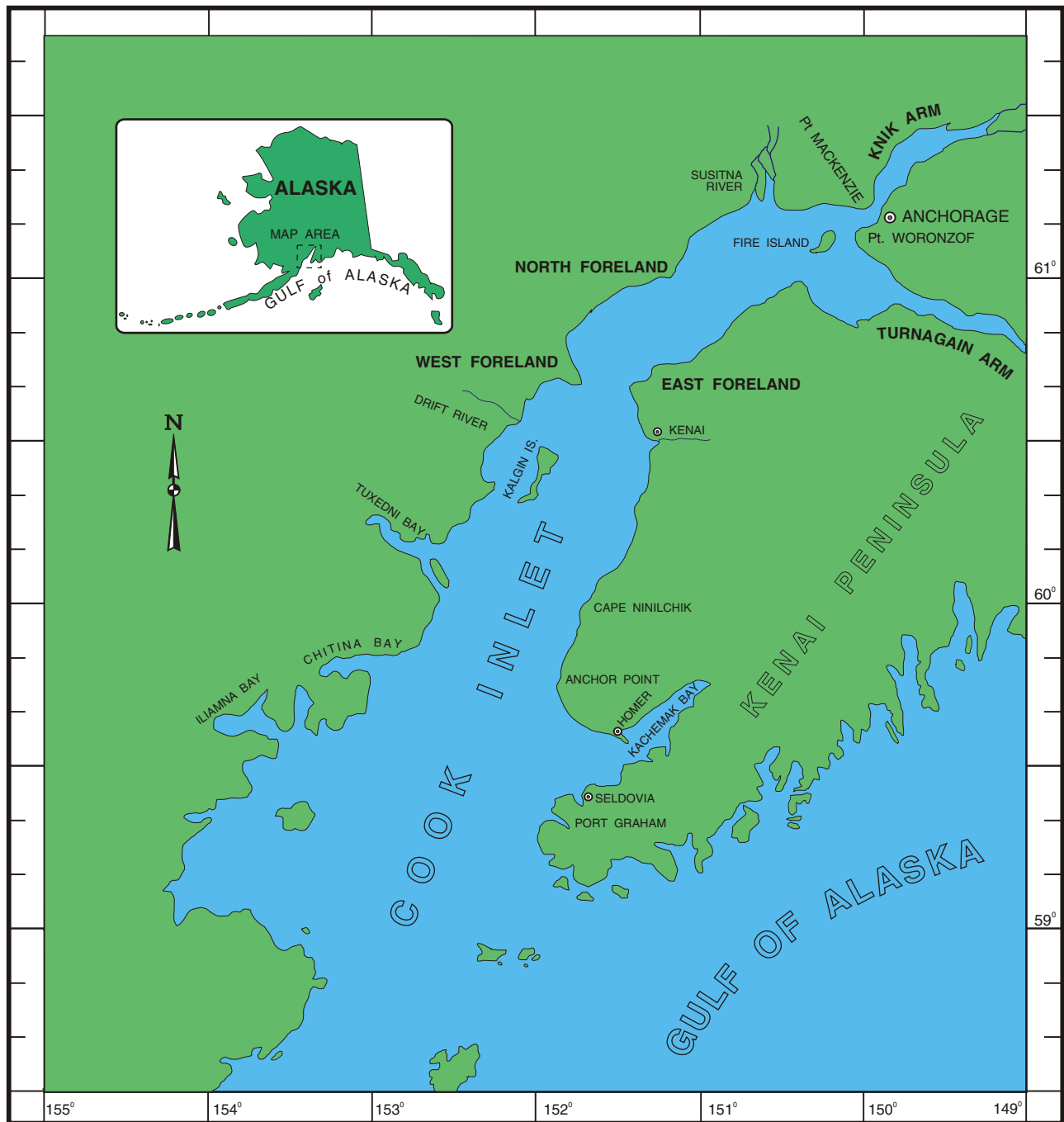
In 1972, while the Asplund WPCF and outfall were being built for the MOA, the Federal Water Pollution Control Act (FWPCA) was amended to establish two phases of effluent limitations applicable to all Publicly Owned Treatment Works (POTWs). Under 301(b), POTWs were required to achieve secondary treatment of effluent by 1 July 1977 and the "best practicable waste treatment technology" by July 1983.

Congress again amended the FWPCA in 1977. Section 301(h) was added, providing that the Administrator of the EPA, upon application from a POTW and with the concurrence of the State, might issue an NPDES permit waiving the requirements of Section 301(b). On 15 June 1979, EPA promulgated the regulations regarding the issuance of this waiver of secondary treatment to an applicant discharging into certain ocean and estuarine waters and demonstrating compliance with the 301(h) criteria.

In September 1979, the MOA forwarded to the EPA a 301(h) waiver application proposing an improved discharge which eliminated chlorination and required the addition of both an extension and diffuser to the Asplund WPCF outfall. Earlier studies had recommended the construction of a 610-m outfall extension and a 305-m diffuser. The proposed extension/diffuser reportedly could meet fecal coliform receiving water standards without chlorination and prevent shore contact of the wastewater plume.

As a parallel program, the MOA undertook preparation of a wastewater master plan for the Anchorage area. The resultant Wastewater Facilities Plan for Anchorage, (Ott Water Engineers, Inc. et al., 1982) and the Environmental Impact Statement, City of Anchorage, Alaska, Wastewater Facilities (EPA and Jones & Stokes, 1982) were accepted by the EPA and ADEC.

Further studies were subsequently undertaken to derive design criteria for the outfall improvements. Significant efforts were included in this study to improve the reconnaissance level data upon which the outfall length and diffuser design were to be based and to evaluate bacterial standards applicable to Knik Arm. The central issue was to evaluate outfall design alternatives and the chlorination or no-chlorination option in relation to the presence of a system of eddies that occur to the east of Point Woronzof on the flood tide and that might be capable of transporting the effluent shoreward. These latter studies were completed and presented as an Amendment to the Wastewater Facilities Plan for Anchorage, Alaska (CH2M Hill et al., 1985).



**Figure 1. General Study Area.**

This amended plan recommended use of the existing 245-m outfall with the addition of a three-nozzle diffuser. It was shown that chlorination would be required to meet bacterial standards even with an extended outfall and diffuser. Because the same standards could be met by use of chlorination and the existing outfall, there was no need to extend the outfall. With continued chlorination, all water quality standards were predicted to be met by the amended plan.

Concurrent with the studies to amend the facilities plan, a revised application entitled Application for Modification of Secondary Treatment Requirements, Section 301(h), Clean Water Act was submitted to the EPA (CH2M Hill et al., 1984). The EPA Region 10 301(h) Review Team's Tentative Decision Document, entitled Analysis of the Section 301(h), Secondary Treatment Variance Application for the Asplund WPCF (EPA, 1985b), and a draft NPDES permit were made available for public comment on 17 January 1985. After comments and appropriate hearings, the Final Permit Decision (EPA, 1985a) was issued 13 September 1985, and the start date of the five-year NPDES Permit AK-002255-1 was listed as 16 October 1985. As required by this permit, a multi-port diffuser was installed at the Asplund WPCF outfall in the beginning of August 1987. This occurred prior to the 1987 summer water quality monitoring program. This original NPDES permit expired on 15 October 1990.

The MOA submitted a renewal application for the permit in April 1990 which addressed amendments made to the 301(h) provisions by the Water Quality Act. That renewal application was not acted upon and the facility continued to operate under an administrative extension of the 1985 permit until August 2000. In 1998 it was projected that the growth of Anchorage would result in the discharge limits contained in the 1985 permit being exceeded within a few years. Therefore, the MOA prepared and submitted another renewal application which replaced the 1990 application in October 1998 (CH2M Hill, 1998).

In tandem with the renewal application, the MOA conducted special studies and submitted a request for site-specific water quality criteria (SSWQC) to the ADEC for the Point Woronzof area of Cook Inlet in December 1998. This request for SSWQC was for turbidity and a suite of metals and was necessitated because the Alaska Water Quality Standards (AWQS) for marine waters could not be achieved for these waters as a result of the naturally high suspended sediment loads in Cook Inlet due to glacial inputs. The approach to the request was based on the EPA's Metals Policy that had been recently promulgated which recommends the use of only the dissolved fraction of metals as bioavailable and appropriate for the protection of aquatic life and associated beneficial uses of the water body. Following both agency and public review and comments, the SSWQC were incorporated into the AWQS as amended on 27 May 1999. The SSWQC for the Point Woronzof area included turbidity and the dissolved fraction of arsenic, cadmium, hexavalent chromium, copper, lead, mercury, nickel, selenium, silver, and zinc.

Following the promulgation of these new AWQS, a tentative decision to grant the MOA its 301(h) variance was made by EPA on 4 November 1999. The tentative decision, draft NPDES permit, and fact sheet were then made available for public review and comments. The State of Alaska's Division of Government Coordination issued its Final Consistency Determination for the action in February 2000. The current NPDES permit for the Asplund WPCF was signed by EPA and went into effect 2 August 2000 for five years, and was administratively extended in August 2005 pending permit renewal. The most recent application for an NPDES permit and 301(h) waiver was submitted in January 2005 and is currently under review by EPA. The NPDES permit specified the required monitoring program. The Monitoring Program Plan (Kinnetic Laboratories, Inc., 2000a), submitted to the EPA in October 2000, identified how the

MOA plans to fulfill the requirements of this program. This report documents the progress and results of the monitoring program performed in 2006 under the current NPDES permit.

Since the issuance of the current Permit, EPA has approved ADEC's proposed use of dissolved metals for the State's marine water quality criteria, approved all of the proposed SSWQC for Upper Cook Inlet in the vicinity of Pt. Woronzof, and removed Alaska from the National Toxic Rule (EPA, 2006). Except for cadmium where the dissolved standard changed from 9.3 µg/L to 8.8 µg/L, all other dissolved metals criteria are the same as those listed in the SSWQC.

### **1.1.2 Environmental Background**

The Asplund WPCF discharges to the receiving waters of Cook Inlet, Alaska. The discharge is located off Point Woronzof in Knik Arm of Upper Cook Inlet.

Cook Inlet is a major tidal estuary that is approximately 333 kilometers (km; 180 nautical miles) long and 93 - 148 km (50 - 80 nautical miles) wide at its lower end. Bathymetry indicates the Inlet is deep, generally 36.6 m (20 fathoms) north of the Forelands and about 164.6 m (90 fathoms) at the mouth. Numerous rivers, including the major Susitna River drainage, discharge into the Inlet. A detailed map of the Point Woronzof region indicates deep water (9.1 - 51.8 m) extending well past Anchorage up the Knik Arm (Figure 2).

Cook Inlet is a unique estuary, with perhaps the closest parallel being the Bay of Fundy between New Brunswick and Nova Scotia, Canada. The occurrence of tidal bores at the head, currents of 4 - 5 knots, suspended loads of up to 2500 mg/L, large temperature extremes, and moving pancake ice of up to one meter (m) thick make Cook Inlet unique. The high tidal ranges result from the geometry of the Inlet which has a natural resonance period close to the semi-diurnal tidal period. The resulting large tidal currents cause complete vertical mixing of the Inlet waters.

In addition to these features, two other factors are important to this study. They are the very large volume of saline water present in the Inlet and the degree of mixing achieved by the tidal turbulence which allows these volumes to be effective in wastewater dilution and assimilation.

The particle size distributions of the natural suspended sediments off Point Woronzof show that very large particles are suspended by the current-generated turbulence, with 50 percent (%) of the load being in the size range of 65 - 250 microns. The settling of large particles is seen in the Inlet at slack tide. Settling rate tests of the suspended material show that 93 % of the solids in the ambient water sample settle in twenty minutes.

Previous work has indicated that due to the extremely swift currents, no seabed accumulation of suspended sediments, either natural or from the discharge, occur in the vicinity of the outfall. In this location, the bottom is strictly coarse gravel and cobble because of these currents. However, areas of deposition do exist, such as to the east of Point Woronzof, where mudflats and beaches are found, and to the southwest of the Point. The area between Fire Island and the mainland is hard-packed sand with no deposition of silt or finer materials as a result of the high current energy. Silt sedimentation is a difficult problem at the Port of Anchorage where the Corps of Engineers conduct annual dredging operations. Of course, any suspended solids in these materials of effluent origin would be diluted by the much larger natural load in the receiving water (400 - 2,500 mg/L versus approximately 50 mg/L effluent).

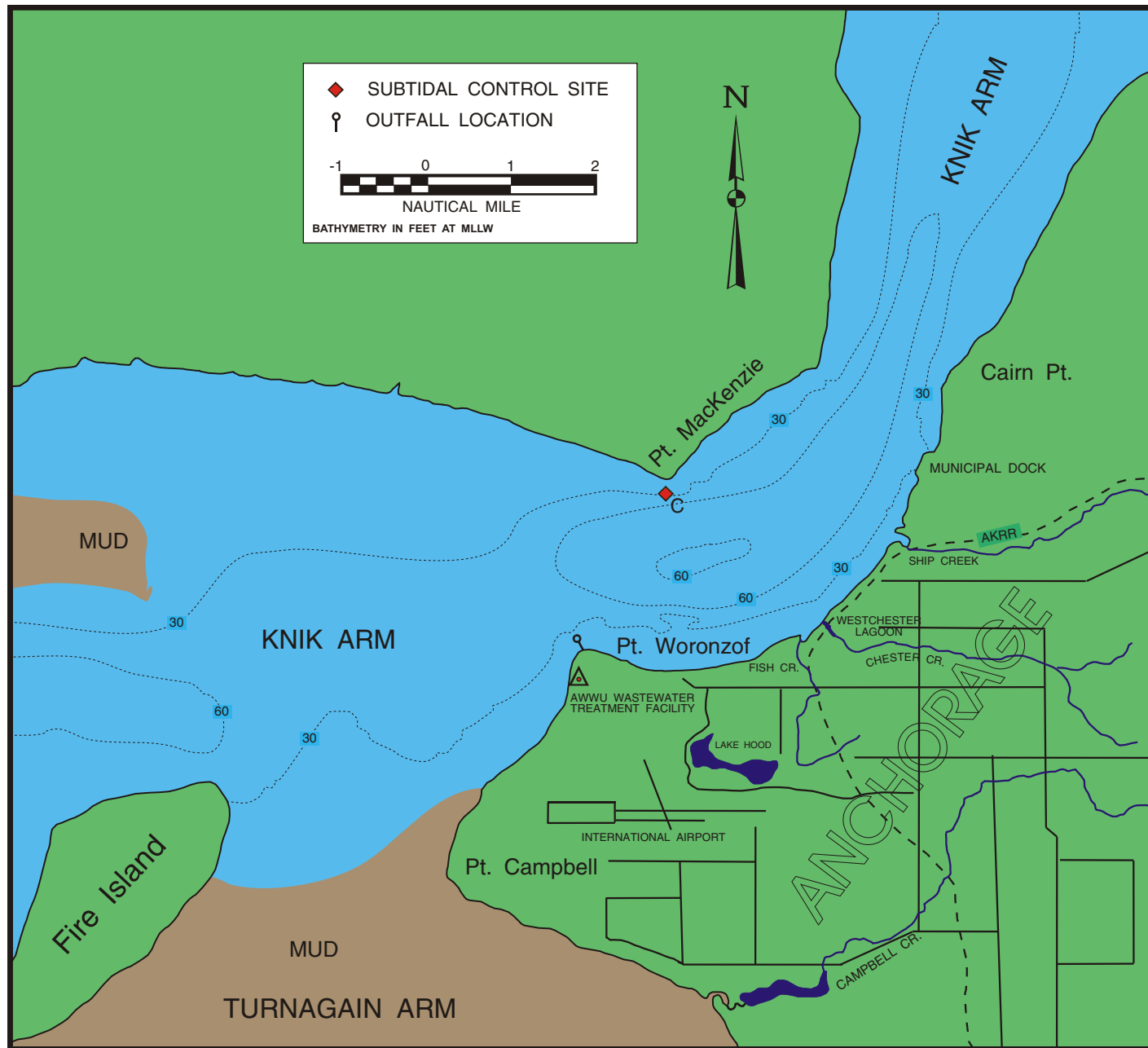


Figure 2. Asplund WPCF Outfall and Control Station Locations.

Studies have also shown that essentially no benthic biota are found on the scoured cobble/gravel bottom or on the rock beaches at Point Woronzof and the control area. Similar sampling of soft bottom beaches and tidal flats showed very sparse abundances and very low diversities. The harsh physical environment of silt, turbulence, currents, tides, and ice, limit benthic and intertidal marine fauna populations.

Current trajectories in the immediate vicinity of the outfall are of concern because of flow separation zones on either side of Point Woronzof. Previous work has indicated that, on a flood tide, a clockwise system of eddies exist east of Point Woronzof. These eddies may result in the shoreward transport of wastes at certain stages of tide. A flow separation also exists to the west of Point Woronzof during ebb flow; however the effluent is not entrained shoreward in this area.

## **1.2 STUDY DESIGN**

### **1.2.1 Monitoring Objectives**

The monitoring program as described by NPDES Permit No. AK-002255-1 includes plant influent/effluent sampling; sewage sludge management procedures; water quality monitoring; biological and toxicological monitoring; and a toxics control program. The objectives of the overall monitoring program are to:

- determine compliance with the NPDES permit
- determine compliance with State of Alaska water quality criteria
- determine effectiveness of the industrial pretreatment program
- aid in assessing the water quality at the discharge point
- characterize toxic substances
- monitor plant performance
- determine compliance with the regulatory criteria of Section 301(h) of the Clean Water Act (CWA)
- determine the level of bacterial concentrations in nearshore waters
- monitor for changes in sediment quality (organic enrichment, alteration of grain size distribution, and pollutant contamination)
- determine if pollutants from the discharge are accumulating in exposed biological organisms
- provide data for evaluation of permit re-issuance

### **1.2.2 Program Description**

The elements of the monitoring program for the Asplund WPCF are:

- Influent, Effluent, and Sludge Monitoring, including
  - In-Plant Sampling
  - Toxic Pollutants and Pesticides (including Metals and Cyanide)
  - Pretreatment Monitoring
  - Whole Effluent Toxicity (WET) Testing
- Receiving Water Quality Monitoring, including
  - Plume Dispersion
  - Intertidal Bacteria

- Biological and Sediment Monitoring, including
  - Sediment Quality
  - Bioaccumulation

Table 1 provides an overview of the monitoring requirements as described by the permit. Detailed information regarding each program component is provided in Section 2.0, Methods.

### 1.2.3 Hypotheses

The null (no effect) hypotheses tested for this year of monitoring as follows:

*H<sub>o1</sub>: Applicable State and Federal effluent and receiving water standards were met by the Asplund WPCF discharge.*

*H<sub>o2</sub>: Water quality at the boundary of the ZID was not significantly changed with respect to nearfield or control stations.*

## 1.3 CONTRACTOR

The MOA's designated contractor for the 2006 Asplund WPCF Monitoring Program was Kinnetic Laboratories, Inc. (KLI) of Anchorage, Alaska.

For influent, effluent, and sludge monitoring, aromatic hydrocarbon, pesticide, and volatile and semi-volatile priority pollutant analyses (gas chromatography/mass spectrometry scans) were performed by Severn Trent Laboratories, Inc. of Sacramento, California and Denver, Colorado. Trace metals (total and dissolved) for the toxic pollutant and pesticide and pretreatment monitoring, normally performed by the Municipality's Asplund WPCF Laboratory was performed by Soil Control Lab of Watsonville, California. WET testing was performed by ToxScan, Inc. also of Watsonville, California. Asbestos analyses were performed by Solar Environmental Services, Inc. of Anchorage, Alaska, and EMSL Analytical of Westmont, New Jersey.

In addition, the Municipality's Asplund WPCF Laboratory performed monthly in-plant analyses as part of its self-monitoring program and conducted Part 503 sludge monitoring.

Analytica Alaska Inc. of Anchorage, under subcontract to KLI, provided analytical and field support for the receiving water sampling for total residual chlorine (TRC). Analytical support for the receiving water sampling included: Battelle for trace metals (Sequim, Washington); SGS Environmental Services, Inc. (Anchorage, Alaska) for color, Soil Control Lab (Watsonville, California) for total suspended solids (TSS), and cyanide; Severn Trent Laboratories, Inc. in Denver, Colorado for aromatic hydrocarbons; Spectra Laboratories in Tacoma, Washington for bacteriology, and Texas A&M University's Geochemical and Environmental Research Group (GERG) in Texas for polycyclic aromatic hydrocarbons (PAHs) analyses.

## 1.4 PERIOD OF REPORT

This report documents the progress and results of the monitoring program from 1 January through 31 December 2006 under the current NPDES permit.

**Table 1. Overall Monitoring Requirements.**

Parameter	Frequency	Sample Type	Remarks
In-Plant Sampling	See Table 2	See Table 2	See Table 2 - includes flow, TRC, DO, BOD <sub>5</sub> , TSS, temperature, pH, fecal coliform, total ammonia as nitrogen, enterococci bacteria, and oil and grease
Toxic Pollutants and Pesticides (including Metals and Cyanide)	2/year <sup>a</sup>	influent, 24-hr composite effluent, 24-hr composite sludge, 24-hr composite	See Table 2
Pretreatment Program	2/year <sup>a,b</sup>	influent, three 24-hr composite effluent, three 24-hr composite sludge, 24-hr composite (8 grabs/day)	Includes metals and cyanide plus percent solids for sludge
Whole Effluent Toxicity (WET) Testing	4/year <sup>c</sup>	effluent, 24-hr composite	See Table 2
Receiving Water Quality	1/year <sup>d</sup>	receiving water	See Table 5
Intertidal Bacteria	1/year <sup>e</sup>	intertidal receiving water	Fecal coliform sampling at 8 intertidal stations
Sediment	Once during the fourth year of the permit <sup>e</sup>	grab samples of surficial (0-2 cm) sediment collected at intertidal and subtidal stations <sup>f</sup>	Includes total volatile solids (TVS), toxic pollutants and pesticides (including metals and cyanide), and sediment grain size distribution
Bioaccumulation	Once during the fourth year of the permit	grab samples of intertidal macroalgae ( <i>Vaucheria</i> spp.)  Note: Macroalgae was not available during 2003 or 2004. Therefore, in consultation with EPA and AWWU pacific cod ( <i>Gadus macrocephalus</i> ) were collected and analyzed for this permit component in October 2004 <sup>g</sup>	Includes toxic pollutants and pesticides (including metals and cyanide)

<sup>a</sup> Sampling will be conducted twice per year: once in summer dry conditions and once in summer wet conditions.

<sup>b</sup> The first day of three consecutive days of sampling will be part of the Toxic Pollutant and Pesticides (metals and cyanide) sampling performed twice each year.

<sup>c</sup> WET testing will be performed on a quarterly basis.

<sup>d</sup> Sampling will be conducted once per year in summer dry conditions.

<sup>e</sup> Sampling will be conducted in conjunction with the receiving water sampling.

<sup>f</sup> Sampling will be performed at Intertidal Stations 1, 2, and Control (IT-1, IT-2, and IT-C); a subtidal station located at the ZID boundary, and a subtidal control station near Point MacKenzie (in a similar water depth as the ZID boundary).

<sup>g</sup> Sampling was to be performed in conjunction with the sediment analyses however algae was not available in sufficient quantities for sampling in 2003 or 2004. Pacific cod were collected and analyzed for this permit component in October 2004.



## 2.0 METHODS

### 2.1 INFLUENT, EFFLUENT, AND SLUDGE MONITORING

Influent, effluent, and sludge monitoring is outlined in Table 2. Routine daily, weekly, and monthly sampling of conventional pollutant parameters and flow rate were performed by AWWU. The less-frequently monitored parameters of enterococci bacteria, oil and grease, toxic pollutants and pesticides (including metals and cyanide), and Whole Effluent Toxicity (WET) testing were handled by AWWU and KLI.

- ✓ determine compliance with the NPDES permit and State of Alaska water quality criteria
- ✓ determine effectiveness of the industrial pretreatment program
- ✓ aid in assessing the water quality at the discharge point
- ✓ characterize toxic substances
- ✓ help monitor plant performance
- ✓ determine compliance with the regulatory criteria of Section 301(h) of the CWA
- ✓ provide data for evaluating re-issuance of this permit

#### 2.1.1 In-Plant Monitoring

In-plant influent, effluent, and sludge sampling was performed by AWWU personnel as described in Table 2 and in a separate study plan provided by AWWU (AWWU, 2000). Samples were obtained following the schedule of frequency required by the permit. Influent was sampled at a representative location in the influent headworks, upstream from the recycle streams. Effluent was sampled at a well-mixed point downstream from the chlorination input (the final effluent line). Composite sludge samples were obtained from the belt filter press. Grab samples were obtained for total residual chlorine (TRC), dissolved oxygen (DO), temperature, pH, and fecal coliform. Composite samples were obtained for analysis of biochemical oxygen demand (BOD<sub>5</sub>), total suspended solids (TSS), and total ammonia as nitrogen.

#### 2.1.2 Toxic Pollutant and Pesticide Monitoring

As outlined in the permit, toxic pollutant and pesticide sampling was conducted twice this year, once during June 2006 (summer dry) and once during August 2006 (summer wet). Samples were collected as required by the permit and either analyzed by AWWU personnel or provided to KLI for shipment to the appropriate analytical laboratory. Plant influent was sampled as discrete grabs or by flow-proportional composite samplers (depending on the analysis method) at a representative location in the influent headworks upstream from the recycle streams. Effluent was sampled as discrete grabs or flow-proportional samplers at a well-mixed point downstream from the chlorination input point in the final effluent line. Influent and effluent samples were chilled as required during composite sampling. Composite sludge samples were obtained from the belt filter press.

Samples were composited for the analysis of pesticides, semi-volatile organics, metals, asbestos, and cyanide. Samples consisted of composites of flow-proportioned samples collected over a 24-hour (hr) period using two ISCO Model 3700 Refrigerated Autosamplers. Grab samples for volatile organics analysis were collected every three hours during the 24-hr sampling period and designated for compositing during analysis at the laboratory. Grab samples were collected for

**Table 2. Influent, Effluent, and Sludge Monitoring Requirements.**

Parameter	Sample Point <sup>a</sup>	Sample Frequency	Sample Type
Flow <sup>b</sup>	effluent	continuous	continuous
Total Residual Chlorine (TRC) <sup>b</sup>	effluent	continuous <u>or</u> every 2-4 hrs	grab
Dissolved Oxygen (DO) <sup>b</sup>	effluent	4/week	grab
Biochemical Oxygen Demand (BOD <sub>5</sub> ) <sup>b</sup>	influent and effluent	4/week	24-hr composite
Total Suspended Solids (TSS) <sup>b</sup>	influent and effluent	4/week	24-hr composite
Temperature <sup>b</sup>	influent and effluent	4/week	grab
pH <sup>b</sup>	influent and effluent	4/week	grab
Fecal Coliform Bacteria <sup>b</sup>	effluent	3/week	grab
Total Ammonia as N <sup>b</sup>	effluent	1/month	24-hr composite
Enterococci Bacteria <sup>c</sup>	effluent	2/year <sup>d</sup>	grab
Oil and Grease <sup>b</sup>	effluent	2/year <sup>d</sup>	grab
Toxic Pollutants and Pesticides (including Metals and Cyanide) <sup>e</sup>	influent, effluent, and sludge	2/year <sup>d</sup>	24-hr composite
WET <sup>f</sup>	effluent	4/year <sup>f</sup>	24-hr composite

<sup>a</sup> When both influent and effluent samples are required, samples will be collected during the same 24-hr period.

<sup>b</sup> AWWU will perform this monitoring component.

<sup>c</sup> KLI will perform this monitoring component.

<sup>d</sup> Twice per year sampling: once during summer in dry conditions and once in wet conditions.

<sup>e</sup> As part of the pretreatment program sampling requirements, arsenic, cadmium, chromium, copper, cyanide, lead, mercury, nickel, silver, and zinc in influent, effluent, and sludge will be sampled, along with percent solids (in sludge only). In 2006, these metals were analyzed and reported by Soil Control Lab as total recoverable metals and dissolved metals for influent and effluent and as total metals in mg/kg dry weight for sludge. Sampling will be as follows: Influent and effluent as three separate 24-hr composite samples taken on 3 consecutive days (Mon - Fri), the first day of which coincides with the twice yearly sampling (summer-dry and-wet conditions); sludge as one composite of eight grabs/day when influent and effluent samples are being taken. In addition, the other four metals from the toxic pollutant list will be analyzed in the summer wet/summer dry samples: beryllium, antimony, thallium, and selenium (by Soil Control Lab).

<sup>f</sup> WET requirements are summarized in the text (Section 2.1.4). Initial testing will be a screening period performed during three quarters, during which three species will be tested to determine the most sensitive species. Re-screening will be performed each year during one quarter (different than the previous year) to determine the species to use for continued testing. Accelerated testing requirements will be triggered if chronic toxicity is greater than 143 TUC (chronic toxicity units, TUC=100/NOEC).

analysis of total hydrocarbons as oil and grease and purgeable aromatic compounds. Sludge samples were collected from the conveyor belt every three hours over a 24-hr period and the eight samples composited.

At time of collection, all samples were appropriately labeled using pre-prepared, project-specific sample labels as described in Section 2.5. Sample collection and shipment was documented using project-specific chain of custody forms as described in Section 2.5.

Toxic pollutants as defined by the permit are those substances listed in 40 Code of Federal Regulations (CFR) 401.15 (Table 3). This list involves 65 categories of pollutants, including asbestos, aromatic hydrocarbons, pesticides, metals, and polychlorinated biphenyls (PCBs). Pesticides as defined in the permit are demeton, guthion, malathion, mirex, methoxychlor, and parathion as listed in 40 CFR 125.58. Other pesticides which were tested are included on the toxic pollutants list (40 CFR 401.15). The methods that were used to analyze these constituents for this program and for which KLI will be responsible, as well as those performed by AWWU, are also provided in Table 3. Preservation and maximum holding time information for each of these methods is provided in Table 4. All samples were collected in the appropriate precleaned sample containers and preserved, if necessary, as described by the EPA method. All sample containers were immediately placed on gel ice after sampling. Samples remained chilled as required during shipment to the analytical laboratory.

### **2.1.3 Pretreatment Monitoring**

The pretreatment program as outlined in Table 1 and Table 2 was performed by the AWWU. This monitoring was performed twice in 2006 in conjunction with the summer dry and wet sampling. As part of the pretreatment program sampling requirements, arsenic, cadmium, chromium, copper, cyanide, lead, mercury, nickel, silver, and zinc in influent, effluent, and sludge were sampled, along with percent solids (in sludge only). These metals are normally analyzed and reported by AWWU however in 2006 they were analyzed by Soil Control Lab as total recoverable metals and dissolved metals for influent and effluent and as total recoverable metals in dry weight for sludge. Sampling was conducted as follows: Influent and effluent as three separate 24-hr composite samples taken on 3 consecutive days (Monday - Friday), the first of which coincided with the twice-yearly sampling (summer dry and summer wet, respectively); sludge as one composite of eight grabs/day when influent and effluent samples were being taken. A detailed study plan describing this monitoring was provided previously (AWWU, 2000).

### **2.1.4 Whole Effluent Toxicity Testing**

As outlined in the permit, the WET testing must be performed on a quarterly basis on 24-hr composite effluent samples. Effluent was sampled by discrete flow-proportional samplers at a well-mixed point downstream from the chlorination input point in the final effluent line. Effluent samples were collected in the appropriate precleaned sample containers as described by the method, chilled, and shipped immediately to the toxicity laboratory for testing. Samples were appropriately labeled at the time of collection using pre-prepared, project-specific sample labels as described in Section 2.5. Sample collection and shipment were documented using project-specific chain of custody forms. Sample containers were immediately placed on gel ice after sampling and remained chilled during shipment to the analytical laboratory.

**Table 3. Methods<sup>a</sup> for the Analysis of Toxic Pollutants and Pesticides for Influent, Effluent, and Sludge Monitoring.**

Volatile Organic Compounds	Semi-Volatile Organic Compounds	Pesticides and PCBs	Inorganic Compounds
<b>EPA 624 (Inf/Eff)</b> <b>SW 8260B (Sludge)</b> Benzene Chlorinated benzenes Dichlorobenzenes Ethylbenzene Toluene Xylenes <sup>b</sup>	<b>EPA 625 (Inf/Eff)</b> <b>SW 8270C (Sludge)</b> Acenaphthene Benzidine <sup>c</sup> Chloralkyl ethers Chlorinated ethanes Chlorinated naphthalenes Chlorinated phenols 2-chlorophenol DDT & metabolites Dichlorobenzenes Dichlorobenzidine 2,4-dichlorophenol 2,4-dimethylphenol Dinitrotoluene Diphenylhydrazine Fluoranthene Haloethers Heptachlor & metabolites Hexachlorobutadiene Hexachlorocyclopentadiene <sup>c</sup> Hexachloroethane Isophorone Naphthalene Nitrobenzene Nitrophenols Nitrosamines Polycyclic aromatic hydrocarbons (PAHs) Pentachlorophenol Phenol Phthalate esters	<b>EPA 614 (Inf/Eff)</b> <b>SW 8141A (Sludge)</b> Demeton Malathion Parathion Guthion <sup>b</sup>	<b>EPA 100.1/EPA 100.2 (Inf/Eff)</b> <b>Polarized Light Microscopy (PLM; Sludge)</b> Asbestos
<b>EPA 624 (Inf/Eff)</b> <b>SW 8260B (Sludge)</b> Acrolein <sup>b</sup> Acrylonitrile <sup>b</sup> Benzene Carbon tetrachloride Chloralkyl ethers Chloroform Chlorinated benzenes Chlorinated ethanes 1,2-dichloroethane Dichloroethylenes Dichloropropane Dichloropropene 1,1,1-trichloroethane Ethylbenzene Halomethanes Methylene chloride Bromoform Dichlorobromomethane Toluene Tetrachloroethylene Trichloroethylene Vinyl chloride	<b>EPA 608 (Inf/Eff)</b> <b>SW 8081A Pesticides and SW 8082 PCBs (Sludge)</b> Aldrin/Dieldrin Chlordane (technical Mixture & metabolites) DDT & metabolites Endosulfan & metabolites Endrin & metabolites Heptachlor metabolites Hexachlorocyclohexane Polychlorinated biphenyls (PCBs) Toxaphene Mirex <sup>b</sup> Methoxychlor <sup>b</sup>	<b>EPA 200.8 (Inf/Eff)</b> <b>SW 6020/SW 3050B (Sludge)</b> Antimony Thallium  <b>EPA 270.3 (Inf/Eff)</b> <b>SW 7741A/SW 3050B (Sludge)</b> Selenium  Note: other inorganic compounds in 2006 were analyzed by Soil Control Lab (Arsenic, Beryllium, Cadmium, Chromium, Copper, Lead, Mercury, Nickel, Silver, Zinc, and Cyanide)	
	<b>SW 8280A (Inf/Eff/Sludge)</b> 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD)		

Inf Influent

Eff Effluent

<sup>a</sup> "EPA" refers to the EPA document *Methods for Chemical Analysis of Water and Wastes*, revised March 1983, Document No. EPA-600/4-79-020 or 40 CFR 136; "SW" refers to the EPA Manual SW 846, *Test Methods for Evaluating Solid Waste*. 3rd Ed., 1986.

<sup>b</sup> Included with expanded method analyte list.

<sup>c</sup> Not the preferred method for this analyte.

**Table 4. Preservation and Analytical Procedures for Influent, Effluent, and Sludge.**

<b>Parameter</b>	<b>Sample Type</b>	<b>Preservation</b>	<b>Maximum Holding Time</b>	<b>Method<sup>a</sup></b>
Temperature	Inf/Eff	None required	Analyze immediately	SM 2550B
pH	Inf/Eff	None required	Analyze immediately	SM 4500-H <sup>+</sup> B
BOD <sub>5</sub>	Inf/Eff	Cool, 4 °C	48 hours	SM 5210B
Total Residual Chlorine	Eff	Fill completely	Analyze immediately	Hach 8167
DO Electrode	Eff	None required	Analyze immediately	SM 4500-O G
Suspended solids	Inf/Eff	Cool, 4 °C	7 days	SM 2540D
Total solids	Sludge	Cool, 4 °C	7 days	SM 2540G
Enterococci	Inf/Eff	Cool, 4 °C, Na <sub>2</sub> S <sub>2</sub> O <sub>3</sub> in effluent	24 hours	SM 9230B
Asbestos	Inf/Eff	Cool, 4 °C, dark	Filter within 48 hours of receipt at lab	EPA 100.1/100.2
	Sludge	Cool, 4 °C	28 days	Polarized Light Microscopy (PLM)
Fecal Coliform Bacteria	Eff	Cool, 4 °C 0.008% Na <sub>2</sub> S <sub>2</sub> O <sub>3</sub>	6 hours	EPA 600/8-78-017
Total Ammonia as N	Eff	Cool, 4 °C, H <sub>2</sub> SO <sub>4</sub> to pH <2	28 days	Hach 8038
Total Hydrocarbons as Oil and Grease	Inf/Eff	Cool, 4 °C, dark HCl to pH<2	28 days	EPA 1664 HEM <sup>b</sup>
Volatile Organics	Inf/Eff	Cool, 4 °C, dark, HCL to pH<2 L- Ascorbic Acid in effluent	14 days	EPA 624
	Sludge	Cool, 4 °C	14 days	SW 8260B
Dioxins	Inf/Eff	Cool, 4 °C	30 days until extraction/45 days after extraction	SW 8280A
	Sludge	Cool, 4 °C	30 days until extraction/45 days after extraction	SW 8280A
Semi-Volatile Organics	Inf/Eff	Cool, 4 °C, dark L- Ascorbic Acid in effluent	7 days until extraction/40 days after extraction	EPA 625
	Sludge	Cool, 4 °C	14 days until extraction/40 days after extraction	SW 8270C
Pesticides & PCBs	Inf/Eff	Cool, 4 °C, L- Ascorbic Acid in effluent	7 days until extraction/40 days after extraction	EPA 614 and EPA 608
	Sludge	Cool, 4 °C	14 days until extraction/40 days after extraction	SW 8141A/8081A SW 8082

**Table 4. Preservation and Analytical Procedures for Influent, Effluent, and Sludge.**  
(continued)

Parameter	Sample Type	Preservation	Maximum Holding Time	Method <sup>a</sup>
Cyanide (total)	Inf/Eff	Cool, 4°C, NaOH to pH>12, 0.6 g L- Ascorbic acid (in effluent)	14 days	SM 4500 CN C,E
	Sludge	Cool, 4°C	14 days	SM 4500 CN C,E
Arsenic	Inf/Eff	Cool, 4°C, HNO <sub>3</sub> to pH<2	6 months	EPA 200.8
	Sludge	Cool, 4°C	6 months	SW 7060/3050A
Beryllium	Inf/Eff	Cool, 4°C, HNO <sub>3</sub> to pH<2	6 months	EPA 200.8
	Sludge	Cool, 4°C	6 months	SW 7091/3050A
Cadmium	Inf/Eff	Cool, 4°C, HNO <sub>3</sub> to pH<2	6 months	EPA 200.8
	Sludge	Cool, 4°C	6 months	SW 7130/3050A
Chromium	Inf/Eff	Cool, 4°C, HNO <sub>3</sub> to pH<2	6 months	EPA 200.8
	Sludge	Cool, 4°C	6 months	SW 7191/3050A
Copper	Inf/Eff	Cool, 4°C, HNO <sub>3</sub> to pH<2	6 months	EPA 200.8
	Sludge	Cool, 4°C	6 months	SW 7210/3050A
Lead	Inf/Eff	Cool, 4°C, HNO <sub>3</sub> to pH<2	6 months	EPA 200.8
	Sludge	Cool, 4°C	6 months	SW 7421/3050A
Mercury	Inf/Eff	Cool, 4°C, HNO <sub>3</sub> to pH<2	28 days	EPA 245.7
	Sludge	Cool, 4°C	28 days	SW 7470
Nickel	Inf/Eff	Cool, 4°C, HNO <sub>3</sub> to pH<2	6 months	EPA 200.8
	Sludge	Cool, 4°C	6 months	SW 7521/3050A
Selenium	Inf/Eff	Cool, 4°C, HNO <sub>3</sub> to pH<2	6 months	EPA 200.8
	Sludge	Cool, 4°C	6 months	SW 7741A/3050B
Silver	Inf/Eff	Cool, 4°C, HNO <sub>3</sub> to pH<2	6 months	EPA 200.8
	Sludge	Cool, 4°C	6 months	SW 7761/3050A
Zinc	Inf/Eff	Cool, 4°C, HNO <sub>3</sub> to pH<2	6 months	EPA 200.8
	Sludge	Cool, 4°C	6 months	SW 7950/3050A
Antimony	Inf/Eff	Cool, 4°C, HNO <sub>3</sub> to pH<2	6 months	EPA 200.8
	Sludge	Cool, 4°C	6 months	SW 6020/3050B
Thallium	Inf/Eff	Cool, 4°C, HNO <sub>3</sub> to pH <2	6 months	EPA 200.8
	Sludge	Cool, 4°C	6 months	SW 6020/3050B (digestion)

<sup>a</sup> Unless otherwise noted, "EPA" refers to the EPA document *Methods for Chemical Analysis of Water and Wastes*, revised March 1983, Document No. EPA-600/4-79-020 or 40 CFR 136; "SM" refers to *Standard Methods for the Examination of Water and Wastewater*, 20th ed., 1998. "SW" refers to the EPA Manual SW 846, *Test Methods for Evaluating Solid Waste*. 3rd Ed., 1986.

<sup>b</sup> EPA, 1999a. Document No. EPA-821-R-98-002.

Inf Influent  
Eff Effluent

Initial WET testing was performed as a screening period over the course of three quarters during each of which three toxicity tests were performed; each with one vertebrate and two invertebrate species. These screening tests were performed during the third and fourth quarters of 2000 and the first quarter of 2001. Screening included the vertebrate *Atherinops affinis* (topsmelt) for survival and growth; an invertebrate bivalve species (either *Mytilus* spp. [mussel; survival and growth] or *Crassostrea gigas* [oyster; larval development]; and an invertebrate echinoderm species fertilization test (*Strongylocentrotus purpuratus* [purple urchin] or *Dendraster excentricus* [sand dollar]). Once the screening period was completed, the single most sensitive species (bivalve) was used for subsequent toxicity testing until re-screening was completed. As required by the permit, re-screening must be performed each year during one quarter (different than the previous year) to determine the most sensitive species to use for continued testing. Re-screening was performed in the second quarter of 2002 and the third quarter of 2003, with bivalves found to be the most sensitive species. Re-screening that was performed during the fourth quarter of 2004, the third quarter of 2005, and the fourth quarter of 2006 found the purple sea urchin to be the most sensitive species.

Accelerated testing requirements will be triggered if chronic toxicity is greater than 143 TUC (chronic toxicity units,  $TUC = 100 / \text{No Observed Effect Concentration [NOEC]}$ ). Accelerated testing will include the implementation of the initial investigation Toxicity Reduction Evaluation (TRE) workplan along with at least one additional toxicity test. If the investigation indicates the source of toxicity (e.g., a plant upset), and no toxicity greater than 143 TUC is observed in this test, the normal schedule of testing will be re-instated. If toxicity greater than 143 TUC is observed, then accelerated testing will continue with six more tests performed on a biweekly basis over a 12-week period. Testing will commence within two weeks of receipt of the sample results of the exceedance. If no toxicity greater than 143 TUC is observed in these tests, then the normal schedule of testing will be re-instated. If toxicity greater than 143 TUC is observed in any of the six tests, then a TRE will be initiated within 15 days of receipt of the sample results of the exceedance. A Toxicity Identification Evaluation (TIE) may also be initiated as part of the overall TRE process, and if this is initiated during the accelerated testing period, the accelerated testing schedule may be terminated or used as necessary in performing the TIE.

Toxicity testing was performed as described in Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Marine and Estuarine Organisms (EPA, 1988) and the 'West Coast Marine Methods Manual', First Edition (EPA, 1995) as required by the permit. The presence of chronic toxicity was estimated as described by these references. Quality assurance for the toxicity testing included the testing of a series of five dilutions and a control, including the concentration of the effluent at the edge of the ZID (0.70 %) as well as two dilutions above and two dilutions below 0.70 %. Reference toxicants were tested concurrently with the effluent testing, using the same procedures. If the effluent tests did not meet all the acceptability criteria as specified in the referenced methods, then the effluent was re-sampled and re-tested as soon as possible. Control and dilution water was natural or synthetic seawater as called for by the referenced methods. If the dilution water was different from the culture water, a second control using culture water will be run. Dilution water met test acceptability criteria.

As part of the WET testing, an initial investigation TRE plan was prepared and submitted to EPA under separate cover (Kinnetic Laboratories, Inc., 2000b). This plan describes the events that will occur should chronic toxicity be detected. As required by the permit and the manual Toxicity Reduction Evaluation Guidance for Municipal Wastewater Treatment Plants (EPA, 1999b), a preliminary TRE will be initiated within 15 days of the receipt of sample results of the

permit exceedance. A more detailed TRE workplan will subsequently be developed to more fully investigate and identify the cause of the toxicity, identify and provide a schedule of the actions that AWWU will use to mitigate the impact of the discharge, and to prevent the recurrence of the toxicity. As noted above, the TIE may be initiated as part of the overall TRE process during the accelerated testing schedule.

### 2.1.5 Part 503 Sludge Monitoring

Operations at the Asplund WPCF include a sludge incinerator that is subject to regulation under 40 CFR Part 503—Standards for the Use or Disposal of Sewage Sludge (Part 503). The current permit requires sludge monitoring twice per year, once during the dry conditions in summer and once during wet conditions as noted above. There are no Part 503 monitoring requirements included in the reissued permit because EPA Region 10's current policy is to remove these requirements from NPDES permits with the intention of writing "sludge only" permits in the future. However, the Part 503 regulations are "self-implementing" in that the facility is required to meet the monitoring requirements in the regulation whether they are specifically included in a permit or not. Therefore, monitoring at the Asplund WPCF includes Part 503 monitoring of sludge. Monitoring frequencies required by 40 CFR Part 503 for incineration are once per 60 days for arsenic, cadmium, chromium, lead, and nickel. Frequency required for mercury is at least once per year. Frequency for beryllium is not specified. AWWU has chosen to also test for mercury and beryllium once per 60 days, more frequently than required, so as to be consistent with the testing frequency for the other metals. Allowable limits are site-specific and were calculated per Part 503 regulation in the *Air Operating Permit Application* submitted by AWWU to ADEC in December 1997 (CH2M Hill, 1997). While methods for this monitoring component have been described elsewhere (AWWU, 2000) and results of the monitoring have been provided under separate reporting requirements to EPA, the data are also included in this report.

## 2.2 RECEIVING WATER QUALITY MONITORING

### 2.2.1 Water Quality Sampling

As called for by the permit, water quality must be monitored annually during the summer in dry weather conditions (Table 1). Sampling was performed at non-fixed stations made during consecutive ebb and flood tides at the outfall station and a single flood tide at the control station. Station locations were determined by following the track of drogues released above the diffuser at the outfall station and at the control station located north across Knik Arm from Point Woronzof, directly off Point MacKenzie in a similar water depth as the outfall. Three drogue tracks on each tide were performed at each location. Four stations were sampled on each drogue track:

- |  |
|--|
| <ul style="list-style-type: none"> <li>✓ determine compliance with the NPDES permit and State of Alaska water quality criteria</li> <li>✓ aid in assessing the water quality at the discharge point</li> <li>✓ determine compliance with the regulatory criteria of Section 301(h) for the CWA</li> <li>✓ determine the level of bacterial contamination in nearshore waters</li> <li>✓ provide data for evaluation of permit re-issuance</li> </ul> |
|--|

- above the diffuser
- as close to the ZID boundary as practicable
- at least one station in the channel of Knik Arm
- in the shallow subtidal area before the drogue grounds.



As noted in the permit, the ZID is defined as the water column above the area delineated by the sector of a circle with the center located over the outfall, 30 meters (m) shoreward of the diffuser, 650 m in radius, and with a 220° angle (Figure 3).

The plume location was followed by using a holey-sock drogue (Figure 4). The drogue consisted of a six-foot cylindrical nylon tube ballasted at the bottom with a two-pound weight and attached at the top with a bridle to a spherical float. This float was attached to the tracking spar via a connecting line. These cylindrical or spherical designs that enclose a parcel of water have been found to more accurately follow the ambient current patterns than other drogue designs such as the window shade design (Sombardier and Niiler, 1994).

Sampling was performed by positioning the vessel over the diffuser (or control station) for the first sampling station of the drogue track. The drogue was released at approximately the same time and followed until navigation information indicated that the ZID had been reached, at approximately 650 m from the outfall, at which time the ZID boundary station was sampled. The third and fourth stations along each drogue track were sampled as the drogue traveled through the channel in Knik Arm and as it slowed in shallow water prior to grounding. Navigation was accomplished using a differential global positioning system (DGPS). If DGPS coordinates were unavailable, a standard GPS receiver was used to obtain navigational information.

Samples were collected for the parameters outlined in Table 5. The surface waters of all stations were sampled for fecal coliform, color, turbidity, and TRC. Surface samples were collected by grabbing directly into the appropriate sample bottles at sample depth (15 - 30 centimeters [cm]). Mid-, and bottom depth turbidity samples were collected at all stations using Niskin<sup>®</sup> bottles. Mid- and bottom depths were determined at each station using the survey vessel's fathometer. Samples were collected as simultaneously as possible at all three target depths. Hydrographic profiles of temperature, salinity, DO, and pH were collected at all stations using a Seabird SEACAT<sup>®</sup> CTD (conductivity, temperature, and depth) recorder. This instrument was also equipped with a DO and pH sensors to allow profiles of these parameters to be recorded. Samples for the analysis of total and dissolved metals, TSS, hydrocarbons (PAH), and total volatile aromatic hydrocarbons (TAH) were collected from surface waters at the first three stations (diffuser, ZID boundary, and channel) along the first flood drogue track at both the outfall and control stations. These samples were collected directly into the appropriate sample containers. A single replicate sample for each parameter or a single profile was collected at each station except for quality control samples, which are described in Section 4.2.

Samples were analyzed following the methods provided in Table 6. Samples were appropriately labeled at time of collection using pre-prepared, project-specific sample labels as described in Section 2.5 and prepared for shipment to the laboratory. Preservation and maximum holding time information for each of these methods is also provided in Table 6. All sample containers were immediately placed on gel ice after sampling. Samples remained chilled as required during shipment to the analytical laboratory.

### **2.2.2 Intertidal Bacterial Sampling**

As part of the water quality monitoring effort, intertidal sampling for fecal coliform bacteria was also performed at eight intertidal stations provided in Table 7 and depicted in Figure 3. Two

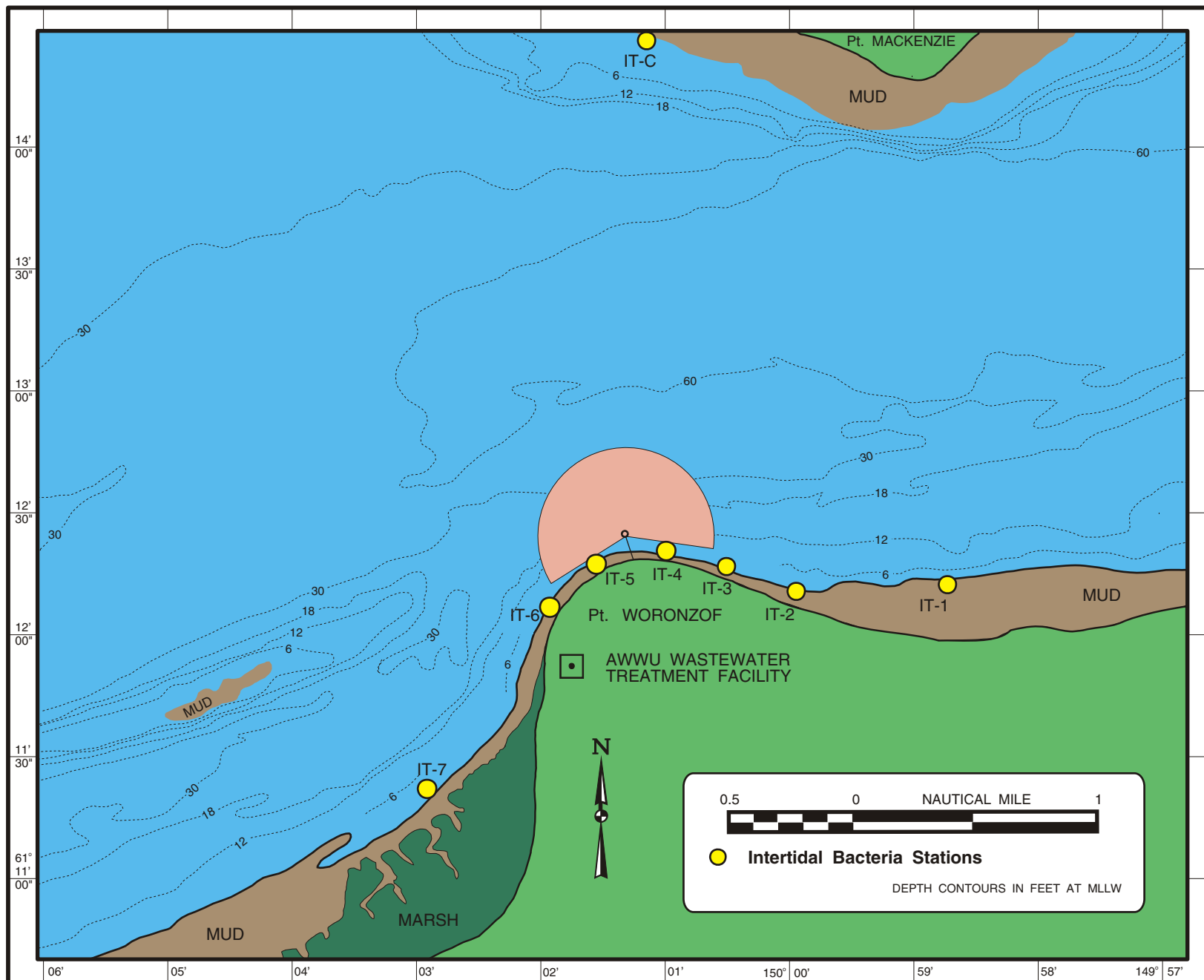
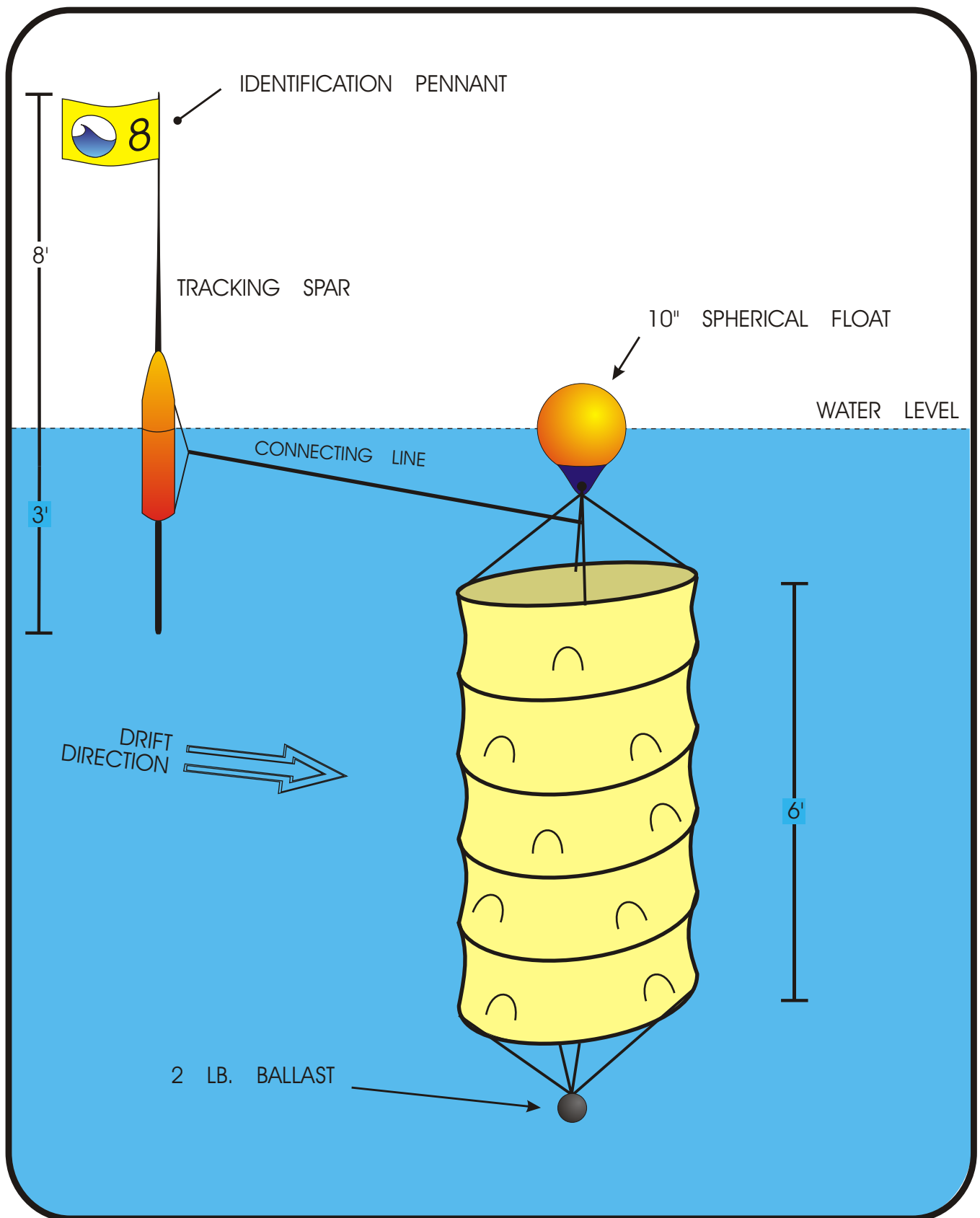


Figure 3. Asplund WPCF Outfall, ZID, and Locations of Intertidal Bacteriological Sampling.



**Figure 4. Holey-Sock Drogue, Flotation, and Marker Buoy.**

**Table 5. Receiving Water Quality Monitoring Requirements.**

Parameter	Sampling Depth		
	Surface (above 0.5 m)	Surface, Mid-, and Bottom	Profile (1- to 3-m intervals)
Fecal Coliform	all stations <sup>a</sup> , within the 15-30 cm layer		
Color	all stations, within the 15-30 cm layer		
Total Residual Chlorine (TRC)			
Field Observations: presence or absence of floating solids, visible foam (other than trace), oil wastes, and/or sheen	all stations where surface samples are collected		
Total Aqueous Hydrocarbons (TAqH)	first three stations along the first flood drogue track at both the outfall and control locations		
Total Aromatic Hydrocarbons (TAH)			
Metals and Cyanide <sup>b</sup>			
Total Suspended Solids (TSS)			
Turbidity		all stations	
pH			all stations
Temperature			
Dissolved Oxygen (DO)			
Salinity			

<sup>a</sup> Non-fixed stations were sampled following the track of drogues released at the diffuser (outfall station) or at a fixed station having the same depth due north across Knik Arm from Point Woronzof near Point MacKenzie (control station). Three drogue tracks were made during each of a consecutive flood and ebb tide at the outfall station. Stations included the following along each outfall drogue track: above the diffuser; as close to the ZID boundary as possible; one near-field station in the channel of Knik Arm; and a far-field station along the drogue path or in the shallow subtidal area before the drogue grounds. Three drogue tracks were also made during a flood tide at the control station in conjunction with or as soon as practicable as the sampling at the outfall station.

<sup>b</sup> Metals include arsenic, cadmium, chromium, copper, lead, mercury, nickel, silver, and zinc; these were analyzed and reported as total recoverable metals and dissolved metals.

**Table 6. Methods, Preservation, and Maximum Holding Times for the Analysis of Receiving Water Quality Samples.**

Parameter	Method <sup>a</sup>	Preservation	Maximum Holding Time
Fecal Coliform	SM 9221E	Cool, 4°C, dark	24 hours
Color	SM 2120B	Cool, 4°C, dark	48 hours
Total Residual Chlorine (TRC)	SM 4500-Cl D	None	Analyze immediately
Turbidity	SM 2130B	Cool, 4°C, dark	24 hours
Total Aqueous Hydrocarbons (TAqH)	EPA 602 plus xylenes	Cool, 4°C, HCl to pH<2, L- Ascorbic Acid in presence of chlorine	14 days
	EPA 610	Cool, 4°C, dark, L- Ascorbic Acid in presence of chlorine	7 days until extraction/ 40 days after extraction
Total Aromatic Hydrocarbons (TAH)	EPA 602	Cool, 4°C, HCl to pH<2 L- Ascorbic Acid in presence of chlorine	14 days
Metals (Total Recoverable and Dissolved)	See note <sup>b</sup>	Cool, 4°C, HNO <sub>3</sub> to pH <2 (after filtration for dissolved)	28 days
Cyanide	EPA 335.2	NaOH, 4°C	14 days
Total Suspended Solids (TSS)	EPA 160.2	Cool, 4°C	7 days
Dissolved Oxygen (DO)	SM 4500-O G (electrode)	None	<i>in situ</i>
pH	SM 4500-H <sup>+</sup> B	None	<i>in situ</i>
Temperature	SM 2550B <sup>c</sup>	None	<i>in situ</i>
Salinity	SM 2520B <sup>c</sup>	None	<i>in situ</i>

<sup>a</sup> "EPA" refers to the EPA document *Methods for Chemical Analysis of Water and Wastes*, revised March 1983, Document No. EPA-600/4-79-020, or 40 CFR 136. "SM" refers to *Standard Methods for the Examination of Water and Wastewater*, 20th ed., 1998.

<sup>b</sup> Dissolved metals were filtered before acidification; total recoverable metals were digested by ASTM Method D4309-91. Cadmium, chromium, copper, nickel, lead, and zinc were subject to pre-concentration by chelation following EPA Method 1640 prior to analysis by inductively coupled plasma mass spectroscopy. These metals, along with antimony, beryllium, selenium, and thallium, were analyzed as total recoverable and dissolved metals as appropriate for ICP/MS (EPA Method 1638). Mercury was analyzed using cold vapor atomic fluorescence following EPA Method 1631. Arsenic was determined in all samples by flame ionization atomic spectroscopy (SW846 Method 7062). Silver was determined by graphite furnace atomic absorption (EPA Method 200.9).

<sup>c</sup> Modified for *in situ* measurements collected with the CTD.

**Table 7. Approximate Locations of Intertidal Bacteria Sampling Stations.**

Station	Station Location Relative to Diffuser	Latitude (N)	Longitude (W)
IT-1	2000 m east	61° 12' 10"	149° 58' 55"
IT-2	1200 m east	61° 12' 11"	149° 59' 50"
IT-3	750 m east	61° 12' 15"	150° 00' 20"
IT-4	250 m east	61° 12' 19"	150° 00' 52"
IT-5	250 m southwest	61° 12' 15"	150° 01' 10"
IT-6	750 m southwest	61° 12' 02"	150° 01' 28"
IT-7	2000 m southwest	61° 11' 22"	150° 02' 02"
IT-C	Across Knik Arm from the diffuser	61° 14' 26"	150° 01' 09"

replicate water samples were collected from each station at slack high water when the water depths were between 1 to 3 feet (ft). Additional quality control samples were collected as described in Section 4.2. Samples were collected by grabbing from 15 - 30 cm depths directly into the appropriate container. Samples were analyzed using the same procedures described above and in Table 6.

In addition to the required intertidal samples, two replicated fecal coliform samples were also collected once during the water quality monitoring effort from three area streams that empty into Knik Arm: Ship, Chester, and Fish Creeks. Samples were analyzed using the same procedures described previously and in Table 6.

At time of collection, all fecal coliform samples were appropriately labeled using pre-prepared, project-specific sample labels as described in Section 2.5. All samples were collected in the appropriate precleaned sample containers, dechlorinated, and preserved, if necessary, as described by the method. Samples were placed on gel ice immediately after sampling and remained chilled during transport to the laboratory. Field notes, including navigational and sampling information, were recorded on project-specific field logs. As required by the permit, field observations taken at each station included the presence or absence of floating solids, visible foam in other than trace amounts, oily wastes, or sheen. Weather observations were also recorded. All field documentation was reviewed by the field leader at the completion of the survey. Sample collection and shipment was documented using project-specific chain of custody forms as described in Section 2.5.

### **2.2.3 Vessel Support**

The *NORTH FORTY*, a 26-ft KLI-owned survey vessel, was used for drogue tracking and water sampling in 2006. In addition, a 14-ft Zodiac<sup>®</sup> was used to retrieve grounded drogues and conduct intertidal bacteria sampling. The Zodiac<sup>®</sup> was also used to transport samples with short holding times (i.e., bacterial samples) ashore.

## **2.3 SEDIMENT AND BIOACCUMULATION MONITORING**

As stipulated in the NPDES permit, sediment and bioaccumulation monitoring was to be performed during the fourth year after the effective date of the permit. Intertidal and subtidal sediment sampling was performed in conjunction with the 2003 receiving water monitoring sampling. Bioaccumulation sampling was performed during 2004.

## **2.4 LABORATORY ANALYSIS**

Laboratory analyses of all samples for this program followed preservation and analysis procedures described by EPA-accepted protocols as referenced in this document (Table 4 and Table 6). These procedures are fully described by the referenced documents and/or 40 CFR 136.

## **2.5 DOCUMENTATION PROCEDURES**

All field and sampling data were recorded on appropriate pre-printed project-specific field data forms. Field data forms included drogue tracking forms, water sampling log forms, sample identification/chain of custody forms, and sample labels. These forms were tailored to the monitoring program to facilitate accurate and complete documentation of field activities. The field task leader was responsible for review and approval of all field documentation; this was completed as soon as possible after sampling.

Sampling logs included specific information such as station identification, sample identification numbers, navigational data, sampling or photographic observations, sampling depths, and collection date and time. Names of personnel performing the sampling were recorded on each log. Drogue tracking logs included station identification information along with navigational data to allow the track of each drogue to be determined and plotted. Pre-printed labels included such information as station designation, analysis type, date of collection, sampling personnel, and a pre-assigned sample identification number to uniquely identify each sample. Quality control samples were labeled as were regular environmental samples so as to be blind to the laboratory analysts.

Sample identification and integrity was ensured by a rigidly-enforced chain of custody program. Sample identification/chain of custody (COC) forms provided specific information concerning the identification, handling, and shipment of samples.

Pertinent information from the sample label was transferred onto the COC, along with other information as required. COC forms were completed, signed by field personnel, and copied if needed. In some cases, where photocopying was not convenient or possible, two-part carbonless forms were used. The original of each COC form was packed with the samples in coolers for shipment to the laboratory. The field task leader retained a copy of each form for the field records and for tracking purposes should a shipment become lost or delayed. Upon receipt of the samples at the analytical laboratory, the laboratory sample custodian signed the samples in by checking all sample labels against the COC information and noting any discrepancies as well as sample condition (e.g., containers leaking or damaged during shipment). Internal sample tracking procedures at the laboratory were initiated immediately upon receipt of samples as described by each laboratory's standard operating procedures.





### **3.0 RESULTS**

#### **3.1 INFLUENT, EFFLUENT, AND SLUDGE MONITORING**

##### **3.1.1 Monthly Discharge Monitoring Data**

Results of AWWU's daily, weekly, and monthly sampling of influent and effluent for non-metals are presented as monthly summaries in Table 8. Averages and percent removal rates are based on the 12-month period from January through December 2006.

Removal of BOD<sub>5</sub> averaged 34 % for the year, and removal of TSS averaged 76 % for the 12-month reporting period. These averages exceed the minimum values required by the amendments to the CWA (40 CFR Part 125.60; Final Rule, 8/9/94), whereby dischargers with 301(h) waivers are required to remove 30 % of BOD<sub>5</sub> and 30 % of the suspended solids. On a monthly average basis, the removal of BOD<sub>5</sub> was slightly less than this limit during March 2006 at 28 %.. The highest monthly average effluent BOD<sub>5</sub> was 165 mg/L, substantially less than the permit limitation of 240 mg/L. All of the BOD<sub>5</sub> values (daily, weekly, and monthly averages) reported for the calendar year 2006 met the permit limitations. Total suspended solids concentrations in the effluent were low and typical of those seen historically at the Asplund WPCF with the highest monthly average effluent concentration of 59 mg/L compared to the permit limit of 170 mg/L. The yearly average TSS was 54 mg/L. Weekly average and daily maximum TSS also met permit requirements.

The highest mean monthly fecal coliform bacteria count was 229 FC MPN/100 mL in July 2006. All of the months in 2006 met the permit limitation of 850 FC MPN/100 mL based on a geometric mean of at least five samples, which ranged from 4 to 229 FC MPN/100 mL, well below the permit limitation. The criterion of not more than 10 % of the samples analyzed should exceed 2,600 FC MPN/100 mL was met ten months out of 12 in 2006. This criterion was not met in July (2 of 13 samples or 15 %) and October (2 of 16 samples or 13 %). Exceedances resulted from a combination of factors which made maintaining an optimal chlorine disinfection level difficult. This included wastewater with an unusually high chlorine demand at times interspersed with periods of low demand due to increased rainfall. The chlorine feed control system is discussed below in Section 5.1.1. All fecal coliform exceedances were reported to EPA on the discharge monitoring reports (DMRs) as required.

The TRC daily maximum limit met the permit-required limitation of 1.2 mg/L this year, with a maximum daily value of 1.2 mg/L and a range of 0.6 to 1.2 mg/L. The monthly averages of TRC concentrations ranged from 0.18 to 0.56 mg/L, with an overall average of 0.34 mg/L. The permit requirement that effluent pH remain between 6.5 and 8.5 standard units was always met, exhibiting a minimum and maximum range of 6.7 to 7.3 pH units for the year.

Although other parameters such as DO, temperature, and ammonia do not have permit limitations, ranges were typical of those seen historically. DO in the effluent exhibited monthly averages ranging from 2.6 to 5.3 mg/L, with a yearly average of 4.0 mg/L. Temperature showed yearly averages of 12.0 and 12.3 °C in the influent and effluent, respectively. Monthly values for total ammonia in effluent ranged from 17.0 to 21.5 mg/L, with a yearly average of 19.4 mg/L.

**Table 8. Discharge Monitoring Data for Influent and Effluent Non-Metals.**

Month	Average Flow Rate (MGD)	Temperature Average (°C)		pH Minimum/Maximum (pH) <sup>a</sup>		TRC Average (mg/L)		DO Average (mg/L)		BOD <sub>5</sub> Average (mg/L)			Total Susp. Solids Average (mg/L)			Fecal Coliform Average (MPN/100 mL)		Total Ammonia Average (mg/L)	
		INF	EFF	INF	EFF	INF	EFF	INF	EFF	INF	EFF	REM (%)	INF	EFF	REM (%)	INF	EFF	INF	EFF
01/06	27.2	10.5	10.6	7.0/7.8	6.8/7.3	NT	0.31	NT	2.6	199	132	34	211	52	75	NT	39	NT	18.2
02/06	27.0	10.3	10.0	7.1/7.6	6.8/7.4	NT	0.29	NT	4.1	233	163	30	225	50	78	NT	32	NT	19.3
03/06	26.1	10.4	10.1	7.1/7.5	6.7/8.1	NT	0.41	NT	4.7	213	152	28	218	54	75	NT	33	NT	19.2
04/06	28.8	10.4	10.6	7.0/7.7	6.6/7.3	NT	0.39	NT	4.6	213	137	36	220	55	75	NT	44	NT	19.9
05/06	26.7	11.4	11.8	6.7/7.5	6.5/7.2	NT	0.36	NT	4.7	235	165	30	232	55	76	NT	29	NT	20.5
06/06	26.8	12.9	13.3	6.9/7.4	6.7/7.2	NT	0.29	NT	4.2	209	146	30	261	59	77	NT	35	NT	21.5
07/06	26.9	14.1	14.7	6.8/7.4	6.8/7.1	NT	0.18	NT	3.3	237	155	35	268	54	80	NT	229	NT	21.4
08/06	31.7	14.8	15.1	6.8/7.4	6.5/7.2	NT	0.34	NT	3.7	229	139	39	242	56	77	NT	42	NT	19.4
09/06	30.3	14.3	14.9	6.7/7.3	6.6/7.3	NT	0.31	NT	3.9	222	138	38	236	54	77	NT	19	NT	17.0
10/06	29.7	13.6	14.0	6.8/7.6	6.7/7.3	NT	0.32	NT	2.9	217	135	38	231	53	77	NT	18	NT	19.0
11/06	28.6	11.9	11.9	6.7/7.5	6.6/7.4	NT	0.36	NT	4.0	214	139	35	196	54	73	NT	9	NT	18.5
12/06	28.5	9.8	10.4	7.0/7.7	6.7/7.3	NT	0.56	NT	5.3	222	147	34	205	54	74	NT	4	NT	19.1
<b>Average</b>	28.2	12.0	12.3	6.9/7.6	6.7/7.3	NT	0.34	NT	4.0	220	146	34	229	54	76	NT	44	NT	19.4

<sup>a</sup> Yearly (minimum-maximum)  
 NT Not tested (tested in effluent only)  
 REM Percent Removal  
 --- Not applicable

### 3.1.2 Toxic Pollutants and Pesticides Analyses

Toxic pollutant and pesticide monitoring for influent, effluent, and sludge was conducted on 27 - 28 June 2006 for summer-dry weather and 15 - 16 August 2006 for the summer-wet sampling. Sampling was performed over a 24-hr period by AWWU personnel.

Results of the toxic pollutant and pesticide analyses are provided in Table 9 (June 2006) and Table 10 (August 2006). For semi-volatile organic compounds (EPA Methods 625/8270C), volatile organic compounds (EPA Methods 624/8260B), and pesticides (EPA Methods 608/8081A and 614/8141A), only those pollutants that were detected in the influent, effluent, or sludge are listed. Refer to Appendices A and B for the laboratory reports and a complete listing of toxic pollutants and pesticides analyzed. A number of the constituents were found only in the sludge. Pollutants found in the influent were often detected in the effluent, and vice versa. In general, pollutant concentrations were low and many of the concentrations reported for the two samplings were below method detection limits (MDLs) or method reporting limits (MRLs).

Percent removal rates shown in these tables were computed from influent and effluent concentration values. Percent removal was only calculated for compounds where a concentration in the influent and/or effluent was reported at a level above the MDL or MRL. Compounds with estimated concentrations (denoted with a "J" qualifier) were not used for percent removal calculation unless a non-estimated concentration was reported for that compound in the other type of sample (influent or effluent). The reported MDL or MRL was used for calculations where necessary (where a compound was reported as non-detect [ND]). Where several laboratory duplicate analyses were performed for a parameter, a percent removal is provided for each duplicate. For summed values, such as the total aromatic hydrocarbons defined as BETX, the MRL or MDL was used for values reported as not detected (ND).

Some of the pollutant removal rates were actually negative values due to the higher concentrations found in the effluent or where a compound was detected in the effluent but not the influent. Both positive and negative removals can be caused by effluent samples being more homogenous due to mixing in the clarifiers, whereas detecting a point-source pollutant in the influent is often more variable. Also, there is a residence time for the effluent in the plant, along with the addition of approximately 1 million gallons/day of well water and city water in the treatment process, therefore the influent does not correspond directly with the effluent.

The types and concentrations of measured organic compounds varied considerably between the two sampling periods. Compounds that were detected in both the influent and effluent samples during at least one of the sampling events included benzene, bis (2-ethylhexyl) phthalate, diethyl phthalate, 1,4- dichlorobenzene, ethylbenzene, chloroform, methylene chloride, phenol, tetrachloroethene, toluene, and total xylenes. Many of these compounds were estimated values that were below their reporting limits and therefore were qualified with a J. Methylene chloride was seen in the blank in August. This compound is a common laboratory contaminant that has been noted in the past; these data were appropriately qualified with a B indicating potential laboratory contamination. Although not detected in the method blanks, diethyl phthalate is another common laboratory contaminant that was seen in the influent and effluent. Compounds that were seen in the sludge as well as the influent and effluent during the June 2006 sampling included an estimated (below MDL) concentration of chloroform along with quantifiable

**Table 9. Toxic Pollutants and Pesticides in the Influent, Effluent, and Sludge, Sampled 27 - 28 June 2006.**

<b>Pollutant</b>	<b>Influent<sup>a</sup> (µg/L)</b>	<b>Effluent<sup>a</sup> (µg/L)</b>	<b>Sludge<sup>a</sup> (µg/g)</b>	<b>Percent Removal</b>
<b>VOLATILES (EPA Methods 624/SW 8260B) – detected substances only</b>				
Benzene	0.50 J	ND (5.0)	0.005 J	---
Chloroform	2.9 J	3.6 J	0.0038 J	---
Ethylbenzene	1.5 J	ND (5.0)	0.030	---
Methylene Chloride	3.5 J	4.5 J	ND (0.016)	---
Toluene	12	8.7	0.290	28
Xylenes (total)	8.3 J	6.7 J	0.180	---
1,4- Dichlorobenzene	1.0 J	1.0 J	0.053	---
Tetrachloroethene	4.2 J	4.0 J	0.100	---
Trichloroethene	ND (5.0)	ND (5.0)	0.0023 J	---
<b>SEMI-VOLATILES (EPA Methods 625/SW 8270C) – detected substances only</b>				
Bis (2-ethylhexyl) phthalate	21	18	47	14
Diethyl phthalate	7.9 J	7.7 J	ND (84)	---
Phenol	27	18	ND (42)	33
<b>HYDROCARBONS</b>				
Oil & Grease (EPA 1664-HEM)	49400	19900	NT	60
Total Aromatic Hydrocarbons as BETX from EPA Method 624	22.3	25.4 <sup>c</sup>	0.505	-14

**Table 9. Toxic Pollutants and Pesticides in the Influent, Effluent, and Sludge, Sampled 27 - 28 June 2006. (continued)**

<b>Pollutant</b>	<b>Influent<sup>a</sup> (µg/L)</b>	<b>Effluent<sup>a</sup> (µg/L)</b>	<b>Sludge<sup>a</sup> (µg/g)</b>	<b>Percent Removal</b>
<b>DISSOLVED METALS</b>				
Antimony	ND (0.50)	ND (0.50)	NT	---
Arsenic	0.66	1.2	NT	-82
Beryllium	ND (0.50)	ND (0.50)	NT	---
Cadmium	ND (0.20)	ND (0.20)	NT	---
Chromium	0.56	0.79	NT	-41
Copper	ND (0.50)	1.4	NT	-180
Lead	ND (0.20)	0.064	NT	-220
Mercury	0.018	0.035	NT	-94
Nickel	2.9	3.7	NT	-28
Selenium	6.1	9.6	NT	-57
Silver	ND (0.20)	ND (0.20)	NT	---
Thallium	ND (0.50)	ND (0.50)	NT	---
Zinc	1.3	3.3	NT	-154
<b>TOTAL METALS</b>				
Antimony	0.96	0.65	1.9	32
Arsenic	2.6	2.4	4.2	7.8
Beryllium	ND (0.50)	ND (0.50)	ND (0.35)	---
Cadmium	0.38	0.27	1.7	29
Chromium	3.9	2.2	16	44
Copper	81	51	240	37
Lead	4.8	2.7	23	44
Mercury	0.11	0.13	1.1/1.1	-18
Nickel	4.1	2.8	14	32
Selenium	ND (1.0)	1.4	3.6	-40
Silver	4.1	3.1	10	24
Thallium	ND (0.50)	ND (0.50)	0.91	---
Zinc	180	100	540	44

**Table 9. Toxic Pollutants and Pesticides in the Influent, Effluent, and Sludge, Sampled 27 - 28 June 2006. (continued)**

Pollutant	Influent <sup>a,b</sup> (µg/L)	Effluent <sup>a,b</sup> (µg/L)	Sludge <sup>a</sup> (µg/g)	Percent Removal
<b>PESTICIDES (EPA Methods 608/SW8081A/8082, 614/SW 8141A) – detected substances only</b>				
Aldrin	0.021 J,COL / 0.020 J	ND (0.050)	0.079	---/---
Azinphos-methyl	ND (2.5) / ND (2.5)	ND (2.5)	3.1	---/---
Dieldrin	ND (0.10) / ND (0.10)	0.010 J,COL	0.0089 J,COL	---/---
Endrin ketone	ND (0.10) / ND (0.10)	0.012 J,COL	ND (0.051)	---/---
Ethyl parathion	ND( 1.0) / ND (1.0)	ND (1.0)	0.051 J	---/---
Gamma-BHC (Lindane)	0.052 / 0.012 J,COL	ND (0.050)	0.018 J,COL	4 /---
Gamma- Chlordane	ND (0.050) / ND (0.050)	ND (0.050)	0.042 J,COL	---/---
4,4' - DDE	ND (0.10) / ND (0.10)	0.0080 J,COL	0.019 J,COL	---/---
Methoxychlor	ND (0.50) / ND (0.50)	ND (0.50)	0.072 J	---/---
<b>ENTEROCOCCI BACTERIA (SM 9230B)</b>				
Enterococci <sup>d</sup>	NT	2400 /2400	NT	---
<b>OTHER COMPONENTS</b>				
Asbestos <sup>e</sup>	ND (<100)	ND (<100)	ND	---
Cyanide	ND (<1)	5	0.36/0.30	-400
Dioxin (2,3,7,8-TCDD )	ND (0.00030)	ND (0.00012)	ND (0.000090)	---

*a* Detection limits or reporting limits are included in parentheses for non-detected (ND) values

*b* Duplicate field sample analysis or duplicate laboratory analysis provided (value/duplicate value)

*c* The BETX summation used the RL where values were reported as ND

*d* Enterococci reported in MPN/100 mL

*e* Asbestos reported in million fibers/L (influent and effluent) and present or none detected (sludge)

COL More than 40% RPD between primary and confirmation column results. The lower of the two results is reported.

J Estimated value (below MDL or MRL)

--- Not applicable (not calculated)

ND None detected

NT Not tested

**Table 10. Toxic Pollutants and Pesticides in the Influent, Effluent, and Sludge, Sampled 15-16 August 2006.**

<b>Pollutant</b>	<b>Influent<sup>a</sup> (µg/L)</b>	<b>Effluent<sup>a</sup> (µg/L)</b>	<b>Sludge<sup>a</sup> (µg/g)</b>	<b>Percent Removal</b>
<b>VOLATILES (EPA Methods 624/SW 8260B) – detected substances only</b>				
Benzene	0.40 J	0.59 J	0.020 J	---
Bromodichloromethane	ND (5.0)	0.34 J	ND (0.079)	---
Chloroform	2.5 J	3.8 J	0.012 J	---
Chloromethane	ND (10)	1.1 J	ND (0.160)	---
1,2- Dichlorobenzene	ND (5.0)	ND (5.0)	0.094	---
1, 4-Dichlorobenzene	1.5 J	1.1 J	0.280	---
Ethylbenzene	0.66 J	0.62 J	0.077 J	---
Methylene chloride	3.8 J,B	3.3 J,B	ND (0.079)	---
Tetrachloroethene	2.1 J	1.4 J	0.430	---
Toluene	7.8	8.7	1.600	-12
Trichloroethene	ND (5.0)	ND (5.0)	0.016 J	---
Xylenes (total)	2.8 J	3.1 J	0.480	---
<b>SEMI-VOLATILES (EPA Methods 625/SW 8270C) – detected substances only</b>				
Bis (2-ethylhexyl) phthalate	14	10	92 J	29
Butyl benzyl phthalate	5.7 J	ND (20)	ND (210)	---
Diethyl phthalate	9.0 J	7.9 J	ND (420)	---
Phenol	ND (10)	13	ND (210)	-30
<b>HYDROCARBONS</b>				
Oil & Grease (EPA 1664-HEM)	51900	19400	NT	63
Total Aromatic Hydrocarbons as BETX from EPA Method 624	11.66	13.0	2.17	-11

**Table 10. Toxic Pollutants and Pesticides in the Influent, Effluent, and Sludge, Sampled 15-16 August 2006. (continued)**

<b>Pollutant</b>	<b>Influent<sup>a</sup> (µg/L)</b>	<b>Effluent<sup>a</sup> (µg/L)</b>	<b>Sludge<sup>a</sup> (µg/g)</b>	<b>Percent Removal</b>
<b>DISSOLVED METALS</b>				
Antimony	ND (0.50)/ND (0.50)	ND (0.50)	NT	---
Arsenic	1.3/1.3	1.9	NT	-46
Beryllium	ND (0.50)/ ND (0.50)	ND (0.50)	NT	---
Cadmium	ND (0.20)/ ND (0.20)	ND (0.20)	NT	---
Chromium	0.66/0.62	0.55	NT	17
Copper	4.8/4.7	26	NT	-442
Lead	0.55/0.50	0.42	NT	24
Mercury	0.032	0.027	NT	16
Nickel	3.0/3.0	2.9	NT	3
Selenium	ND (1.0)/ ND (1.0)	1.1	NT	-10
Silver	0.25/0.24	ND (0.20)	NT	20
Thallium	ND (0.50)/ ND (0.50)	ND (0.50)	NT	---
Zinc	12/11.55	35	NT	-192
<b>TOTAL METALS</b>				
Antimony	0.81	0.58/0.60	1.6	28
Arsenic	2.8	2.6/2.8	4.4	7
Beryllium	ND (0.50)	ND (0.50)/ ND (0.50)	ND (0.79)	---
Cadmium	0.37	0.24/0.25	1.6	35
Chromium	4.9	2.8/2.7	25	43
Copper	81	49/48	230	40
Lead	7.1	2.9/2.9	25	59
Mercury	0.17	0.10	0.91/0.90	41
Nickel	7.7	4.2/4.3	14	45
Selenium	1.2	1.4/ ND (0.50)	4.5	-17
Silver	4.3	2.3/2.4	11	47
Thallium	ND (0.50)	ND (0.50)/ ND (0.50)	2.1	---
Zinc	200	97/96	570	52



**Table 10. Toxic Pollutants and Pesticides Detected in the Influent, Effluent, and Sludge, Sampled 15–16 August 2006. (continued)**

<b>Pollutant</b>	<b>Influent<sup>a</sup> (µg/L)</b>	<b>Effluent<sup>a,b</sup> (µg/L)</b>	<b>Sludge<sup>a</sup> (µg/g)</b>	<b>Percent Removal</b>
<b>PESTICIDES (EPA Methods 608/SW8081A, SW8082, 614/SW 8141A) – detected substances only</b>				
alpha-BHC	ND (0.050)	0.023 J	ND (0.054)	---
beta-BHC	ND (0.050)	ND (0.050)	0.039 J,COL	---
delta-BHC	0.0084 J	ND (0.050)	ND (0.054)	---
Dieldrin	ND (0.10)	0.021 J	ND (0.054)	---
Endosulfan II	ND (0.10)	0.042 J	ND (0.054)	---
Heptachlor	0.47	0.54	0.640	-15
Methoxychlor	ND (0.50)	ND (0.50)	0.018 J,COL	---
<b>ENTEROCOCCI BACTERIA (SM 9230B)</b>				
Enterococci <sup>d</sup>	NT	1.0/1.0	NT	---
<b>OTHER COMPONENTS</b>				
Asbestos <sup>e</sup>	ND (<100)	ND (<100)	ND	---
Cyanide	ND (<1)	ND (<1)	0.22/0.24	---
Dioxin (2,3,7,8-TCDD)	ND (0.00012)	ND (0.000088)	ND (0.0003)	---

*a* Detection or reporting limits are included where possible in parentheses for non-detected (ND) values

*b* Duplicate field sample analysis or duplicate laboratory analysis provided (value/duplicate value)

*c* The BETX summation used the MDL where values were reported as ND

*d* Enterococci reported in MPN/100 mL

*e* Asbestos reported in million fibers/L (influent and effluent) and present or none detected (sludge)

--- Not applicable (not calculated)

B Method blank contamination

COL More than 40 % RPD between primary and confirmation columns results. The lower of the two results is reported.

J Estimated value (below MDL or MRL)

ND None detected

NT Not tested

(non-estimated) concentrations of toluene, total xylenes, 1,4- dichlorobenzene, tetrachloroethene and bis (2-ethylhexyl) phthalate. An estimated concentration of trichloroethene was also seen in the sludge sample for June 2006, but this compound was not detected in the influent or effluent for this sampling event. In August 2006, of those compounds that were detected in both the influent and effluent; benzene, chloroform, 1,4-dichlorobenzene, ethylbenzene, tetrachloroethene, toluene, total xylenes, and bis (2-ethylhexyl) phthalate were also seen in the sludge. In addition, 1,2-dichlorobenzene and trichloroethene were detected in the sludge in August 2006, although they were not detected in the influent or effluent during this sampling event. Again, many of these concentrations were estimated and qualified with a J as they fell below method detection limits.

Oil and grease concentrations measured in the influent and effluent in 2006 using EPA 1664 HEM were similar to those seen in 2005 with effluent concentrations in the range of 19-20 mg/L. Oil and grease effluent concentrations for 2005 were in the range of 18-21 mg/L. Effluent BETX concentrations as measured by EPA 624 were 25.4 and 13.0 µg/L in the June and August 2006 samplings, respectively. Total aromatic hydrocarbons as BETX (EPA 602) and PAHs were also sampled in the effluent as part of the receiving water program. Refer to Sections 5.1 and 5.2 for further discussion of the significance of the total hydrocarbon values.

The AWQS have site-specific criteria for the Point Woronzof area that are based on dissolved metals in the receiving water. These SSWQC were utilized to determine the MAEC (defined as the value specified as the receiving water limit and/or the permit limit multiplied by the initial dilution of 142:1 for conservative substances and 180:1 for non-conservative substances after taking into account the natural background concentration). Both total and dissolved concentrations of metals in the effluent were then compared to the MAECs.

Total metals concentrations in the influent and effluent were generally found to be low. Influent and effluent concentrations of total beryllium and thallium were below detection limits during both sampling periods. Total selenium was seen at low levels in the influent and effluent during August, but only in the effluent during the June sampling. Other total recoverable metals such as arsenic, chromium, copper, lead, mercury, nickel, silver, and zinc were seen in the influent and effluent during both sampling events, but at very low levels when compared to their respective MAECs.

Dissolved metals concentrations were also generally found to be low. Dissolved antimony, beryllium, cadmium, and thallium were found to be below detection limits for both influent and effluent during both sampling periods. Dissolved arsenic, chromium, mercury, nickel and zinc were above detection limits in both influent and effluent during both sampling events, while dissolved silver was reported above the detection limit in the influent only during the August sampling. Dissolved lead was seen at low levels in the effluent only during June 2006 and in both influent and effluent during August 2006. Dissolved selenium during June 2006 was found to be higher in both the influent and effluent when compared to total selenium concentrations for the same samples. The cause of this discrepancy was attributed by the laboratory to an unknown matrix affect. The concentration for dissolved copper in effluent was found to be the highest of any of the metals with respect to its MAEC of 317 µg/L, with a level of 26 µg/L during the August 2006 sampling, still approximately an order of magnitude less than the MAEC.

Several pesticides were detected in the influent, effluent, or sludge during the June and August 2006 sampling events. Of the pesticides detected, only Heptachlor was detected in both the

influent and effluent at concentrations above the MDL during the August 2006 sampling. All other concentrations of pesticides were detected at levels below the MDL (therefore qualified with a J). No PCBs were detected in either the June or August 2006 sampling. For a complete list of the various pesticide analytes, refer to Appendices A3 and B3.

The permit calls for the analysis of enterococci bacteria in effluent twice per year in conjunction with the summer dry and summer wet sampling. The enterococci in the effluent was reported as 2,400 and 2,400 most probable number (MPN)/100 mL for the June 2006 sampling and 1.0 and 1.0 MPN/100 mL for the replicates taken during the August 2006 sampling event.

Asbestos was not detected in influent, effluent, or sludge during either sampling event. The concentration of cyanide in the influent was less than the detection limit of 1 µg/L during the June 2006 sampling event while the effluent concentration was 5 µg/L. as compared to an MAEC of 181 µg/L. For the August 2006 sampling event both influent and effluent concentrations were less than the detection limit of 1 µg/L. Cyanide was detected in sludge at 0.36 µg/g in June 2006 and at 0.22 µg/g in the August 2006 sampling event. Dioxins (2,3,7,8-TCDD) were tested in influent, effluent, and sludge during both sampling events, but none were detected.

### **3.1.3 Pretreatment Monitoring Data**

As part of the NPDES permit, AWWU is to conduct pretreatment monitoring twice per year in conjunction with the toxic pollutant and pesticide analyses. This monitoring includes three consecutive days of 24-hr composite sampling of the influent and effluent. Pretreatment analyses include cyanide and a suite of metals that are analyzed as both total and dissolved. Results of the pretreatment monitoring are presented in Table 11.

Collection of samples for metals analysis as part of the toxic pollutant and pesticide sampling events in June and August 2006 coincided with the first day of the pretreatment monitoring performed by Soil Control Lab for the Asplund WPCF during 2006, as discussed in Section 3.1.2. Metals concentrations for the two additional days of each 3-day pretreatment sampling event were typically similar to those discussed above, particularly for the effluent. For example, dissolved copper in the effluent was reported at 26 µg/L during the first day of pretreatment sampling in August 2006 and at 24 and 19 µg/L on the other two days of sampling. Influent values were often more variable than those seen in effluent, as would be expected.

Of all the metals in the effluent, total copper and zinc concentrations were the highest, but values for these metals were still well below their respective MAECs. Dissolved copper in the effluent was found to range from 1.4 to 26 µg/L for the six pretreatment samples, as compared to the MAEC of 317 µg/L. Total copper in the effluent ranged from 49 - 77 µg/L during the pretreatment sampling. Dissolved zinc in the effluent ranged from 1.1 - 35 µg/L during both pretreatment samplings, while total zinc ranged from 94 to 110 µg/L during these samplings as compared to an MAEC of 11,249 µg/L. Dissolved mercury ranged from 0.027 µg/L to 0.037 µg/L, while total mercury ranged from 0.083 to 0.10 µg/L in all six effluent pretreatment samples, as compared to the MAEC of 2.73 µg/L. Other metals were also found to be substantially less than their respective MAECs. Total cyanide was below detection limits (<1.0 µg/L) in five of the six effluent pretreatment samples collected, as compared to an MAEC of 181 µg/L. Total cyanide was detected at 5 µg/L on the first day of the June sampling.

**Table 11. Pretreatment Monitoring Data for Influent and Effluent Metals and Cyanide.**  
Concentrations are in µg/L.<sup>a</sup>

Parameter	June 2006						August 2006					
	Influent			Effluent			Influent			Effluent		
Sample Date	27	28	29	27	28	29	15	16	17	15	16	17
<b>Dissolved Metals</b>												
Arsenic	0.66	0.70	0.79	1.2	1.1	1.3/1.2	1.3/1.3	1.3	1.4	1.9	1.9	2.0
Beryllium*	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50/ <0.50	<0.50/ <0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Cadmium	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20/ <0.20	<0.20/ <0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Chromium	0.56	0.70	2.1	0.79	0.60	1.1/1.1	0.66/ 0.62	0.58	0.56	0.55	0.62	0.52
Copper	<0.50	0.81	3.4	1.4	1.7	1.9/1.9	4.8/4.7	4.2	3.8	26	24	19
Cyanide	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Lead	<0.20	<0.20	0.22	0.64	<0.20	0.23/0.38	0.55/ 0.50	0.65	0.22	0.42	0.70	0.28
Mercury	0.018	0.033	0.032/ 0.038	0.035	0.035	0.035	0.032	0.027	0.037	0.027	0.037	0.033/ 0.037
Nickel	2.9	4.0	3.4	3.7	2.6	3.0/3.2	3.0/3.0	2.4	4.8	2.9	2.6	2.7
Silver	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20/ <0.20	0.25/ 0.24	<0.20	<0.20	<0.20	<0.20	<0.20
Zinc	1.3	1.9	2.9	3.3	1.1	1.5/1.4	12/12	13	11	35	33	30
<b>Total Metals</b>												
Arsenic	2.6	2.9	3.2	2.4	2.6	3.0	2.8	3.0	3.1	2.6/2.8	2.8	2.7
Beryllium*	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50/ <0.50	<0.50	<0.50
Cadmium	0.38	0.36	0.47	0.27	0.28	0.37	0.37	0.43	0.30	0.24/ 0.25	0.24	0.24
Chromium	3.9	6.3	15	2.2	3.1	6.6	4.9	5.5	4.3	2.8/2.8	2.0	1.9
Copper	81	88	93	51	60	55	81	85	75	49/48	58	77
Cyanide	<1	<1	<1	5	<1	<1	<1	<1	<1	<1	<1	<1
Lead	4.8	4.1	6.6	2.7	2.7	4.1	7.1	7.8	1.8	2.9/2.9	3.2	2.1
Mercury	0.11	0.090	0.22	0.13	0.083	0.090	0.17	0.12	0.12	0.10	0.099	0.089
Nickel	4.1	6.3	11	2.8	3.3	5.7	7.7	5.4	9.7	4.2/4.3	3.6	3.9
Silver	4.1	4.2	3.6	3.1	3.1	2.9	4.3	2.5	6.5	2.3/2.4	2.0	2.4
Zinc	180	180	200	100	100	110	200	190	190	97/96	96	94

<sup>a</sup> Duplicate lab analyses provided (value/duplicate value)

\* Not required by permit for "Pretreatment" monitoring

NT Not tested

Values reported as "<" (less than), are reporting limits

### 3.1.4 Whole Effluent Toxicity Testing Results

Quarterly WET testing was conducted on 24-hr flow composite effluent samples as required under the permit during all four quarters of calendar year 2006. Echinoderm fertilization tests were performed using the purple sea urchin, *Strongylocentrotus purpuratus*, during the first, second, and third quarters of 2006. Use of this test during the first three quarters was based on the screening test results from the third quarter of 2005, which had determined the sea urchin to be the most sensitive species tested (see Section 2.1.4). Annual re-screening for the most sensitive species in 2006 was performed during the fourth quarter, and the sea urchin was again found to be the most sensitive species tested.

Results of all the tests performed in 2006 are summarized below and presented in Table 12 as the lowest observed effect concentration (LOEC), no observed effect concentration (NOEC), and in chronic toxicity units (TUC), where  $TUC = 100/NOEC$ . Detailed results in the form of descriptive laboratory reports that present all data in tabular form along with statistical analyses, QA/QC information, and reference toxicant test results have previously been submitted to EPA with the monthly DMRs and are presented in Appendix C.

**Table 12. Summary of WET Test Data from 2006.**

Toxicity Test	LOEC (%)	NOEC (%)	TUC
<b>1<sup>st</sup> Quarter 2006</b>			
Echinoderm (fertilization)	2.8	1.4	71.4
<b>2<sup>nd</sup> Quarter 2006</b>			
Echinoderm (fertilization)	> 2.8	≥ 2.8	≤ 35.7
<b>3<sup>rd</sup> Quarter 2006</b>			
Echinoderm (fertilization)	2.8	1.4	71.4
<b>4<sup>th</sup> Quarter 2006</b>			
Bivalve (survival)	> 2.8	≥ 2.8	≤ 35.7
Bivalve (development)	> 2.8	≥ 2.8	≤ 35.7
Topsmelt (survival)	> 2.8	≥ 2.8	≤ 35.7
Topsmelt (growth)	> 2.8	≥ 2.8	≤ 35.7
Echinoderm (fertilization)	1.4	0.7	142.9

First quarter 2006 echinoderm fertilization testing was performed on a single 24-hr composite sample collected on 8-9 February 2006. A previous effluent sample had been collected on 23-24 January 2006, however this first bioassay did not meet test acceptability criteria (TAC) with a very strong response in the reference toxicant test. Therefore, results of the first quarter WET testing are from the second (repeat) sample. Results from this sample showed a significant decrease in egg fertilization at the 2.8 % sample concentration with an LOEC of 2.8 % and a NOEC of 1.4 % effluent. The TUC was 71.4, which was well within the permit maximum allowable limit of 143.

Sampling for the second quarter WET testing with echinoderms was performed on 17-18 April 2006. Results of the second quarter testing showed there was no significant reduction in fertilization at any of the sample concentrations tested, with an LOEC of  $>2.8\%$ , an NOEC of  $\geq 2.8\%$ , and a TUC of  $\leq 35.7$ . All test validity criteria were met and reference toxicant tests were within laboratory control chart limits which indicated typical sensitivity of the test populations for these tests.

The third quarter testing with echinoderms was performed on 15-16 August 2006. Results of the third quarter WET retesting showed a significant decrease in egg fertilization at the  $2.8\%$  sample concentration tested, with an LOEC of  $2.8\%$  and a NOEC of  $1.4\%$  effluent. The TUC was 71.4, which was well below the permit maximum of 143. All test validity criteria were met and reference toxicant tests were within laboratory control chart limits which indicated typical sensitivity of the test populations for these tests.

The three-species WET testing was performed during the fourth quarter of 2006. The test included: the bivalve larvae, *Mytilus galloprovincialis*, survival and development; topsmelt, *Atherinops affinis*, survival and growth; and echinoderm, *Strongylocentrotus purpuratus* fertilization. The testing was performed on effluent samples collected from 30 October to 4 November 2006.

Results of the bivalve testing showed that none of the effluent concentrations produced a significant decrease in survival or normal development of the test organisms. Both reference toxicant tests were within laboratory control chart limits and indicated typical sensitivity of the test population.

Results of the topsmelt larval survival and growth testing performed showed no concentration of effluent tested produced significant mortality or significantly decreased growth of topsmelt larvae when compared to seawater-only controls. Concurrent reference toxicant testing for survival and growth were within laboratory control chart limits and indicated typical sensitivity of the test population. Also, all test acceptability criteria (TAC) were met in both effluent and reference toxicant bioassays.

Results of the echinoderm fertilization test conducted during the fourth quarter showed that significant decrease in egg fertilization occurred at the  $2.8\%$  and  $1.4\%$  effluent concentrations when compared to the seawater-only controls. The NOEC for fertilization was therefore  $0.7\%$  and the LOEC was  $1.4\%$ , with a TUC of 142.9, meeting the allowable permit limit of not exceeding 143. Results of these tests indicated that the echinoderm was the most sensitive of the three species tested for the Anchorage WPCF effluent.

### **3.1.5 Part 503 Sludge Monitoring Data**

The AWWU operates a sludge incinerator at the Asplund WPCF for which the NPDES permit requires sludge monitoring twice per year as part of the "Toxic Pollutants and Pesticides/Pretreatment" sampling requirements. As described in Section 2.1.5, AWWU performed Part 503 sludge monitoring with a minimum frequency of once every 60 days. These data will be submitted along with other incinerator operational information to EPA by 19 February 2007. This submittal will take the form of a separate report; however, for completeness and for comparison purposes, this information has been included here as well.

Results of the sludge monitoring for metals for the year are presented in Table 13. Metals concentrations were extremely low compared to allowable limits and very similar to those seen historically. The only metal that had historically been elevated for some sampling events was arsenic. In 2006, the highest concentration of arsenic in the sludge was 5.94 mg/kg compared to the allowable limit of 95.8 mg/kg. As mentioned above, no actual limits exist in the current NPDES permit. Allowable limits are site-specific and were calculated by the permittee per Part 503 regulations. EPA plans to issue sludge only permits in the future; in the interim, 40 CFR Part 503 regulations are “self-implementing”.

### **3.2 RECEIVING WATER QUALITY MONITORING RESULTS**

Water quality sampling of the receiving water was conducted on 27 - 28 June 2006, concurrent with the summer dry sampling. Sampling results are contained in the following subsections.

#### **3.2.1 Plume Dispersion Sampling**

##### **Drogue Tracking Results**

Drogues were released on 27 June 2006 at the ZID station for the ebb and flood tidal cycles and on 28 June 2006 at the control station for the flood tidal cycle. Three drogues were deployed during each tidal cycle.

##### **ZID Site**

The Point Woronzof ebb drogue drop and tracking cycles were performed during the morning of 27 June 2006. The tidal range during ebb stage was 29.2 feet (Figure 5 and Table 14; Micronautics, Inc. Tide 1: Rise and Fall®, 2006). A composite of the ebb drogue deployments is depicted in Figure 6.

The ebb drogues traveled from approximately 1.5 to 3 nautical miles, all three traveling in a southwesterly direction. No eddies were observed during these drogue tracks, nor did any of the drogues become grounded during their tracks. The first ebb (E1) drogue was released at 09:32 Alaska Daylight Time (ADT), about 45 minutes after high tide. This drogue tracked west-southwest and well north of the shoal that is evident at low water approximately one mile southwest of Point Woronzof. This drogue traveled at approximately 140 centimeters per second (cm/s) over its entire track of about 3 nautical miles. The second ebb drogue (E2) was released at 11:14 ADT and tracked along an almost identical track as the first drogue, well north of the shoal, traveling slightly further with an average speed of 120 cm/s over the entire track. The third drogue (E3) was released at 13:14 ADT nearly 4 ½ hours after high slack. This drogue initially followed a similar path to the first two drogues, traveling in a west southwesterly direction, then more southerly between shore and south of the shoal that was evident at low tide. This drogue traveled approximately 1.5 nautical miles at 76 cm/s over its entire track.

Flood drogue tracks are depicted in Figure 7. The tidal range during flood stage was 28.8 feet (Figure 5 and Table 14; Micronautics, Inc. Tide 1: Rise and Fall®, 2006). No eddies were observed during these drogue tracks, nor did any of the drogues become grounded during their tracks. The first flood drogue (F1) was deployed on 27 June at 16:03 ADT at low slack water at the outfall and tracked until 17:27 ADT. This drogue traveled easterly along the shoreline on the

**Table 13. Part 503 Discharge Monitoring Data for Sludge Metals.** Concentrations are in mg/kg dry weight. All metals are reported as total metals.

Parameter	Arsenic	Beryllium	Cadmium	Chromium	Lead	Mercury	Nickel
MDL	0.3	0.02	2/0.05 <sup>b</sup>	3/0.2 <sup>b</sup>	0.2	0.06	3/0.2 <sup>b</sup>
Site-Specific Permit Limit <sup>a</sup>	95.8	500 <sup>c</sup>	66.6	2,466	7,707	9.63 <sup>d</sup>	102,764
02/07/06	1.9	0.10	3	13	39.3	0.77	16
04/13/06	2.6	0.14	3	18	32.3	0.61	19
06/02/06	2.6	0.15	3	17	21.7	1.70	18
06/27-28/06 <sup>e</sup>	4.2	ND (<0.35)	1.7	16	23	1.10	14
08/15-16/06 <sup>e</sup>	4.4	ND (<0.79)	1.6	25	25	0.91	14
10/24/06 <sup>f</sup>	5.94	ND (<0.308)	1.53	17.6	25.9	0.507	13.1
12/11/06 <sup>f</sup>	5.08	ND (<0.308)	1.23	15.5	18.2	0.390	11.9
MINIMUM	1.9	ND	1.23	13	18.2	0.390	11.9
MAXIMUM	5.94	0.15	3	25	39.3	1.70	19
AVERAGE	3.8	0.06	2	17	26	0.86	15

MDL Method detection limit

<sup>a</sup> Site Specific Allowable Limits calculated in *Air Operating Permit Application* submitted to ADEC.

<sup>b</sup> Cadmium, chromium, and nickel were analyzed by furnace method EPA 7130, 7190 and 7520 respectively, on the Feb.-June samples.

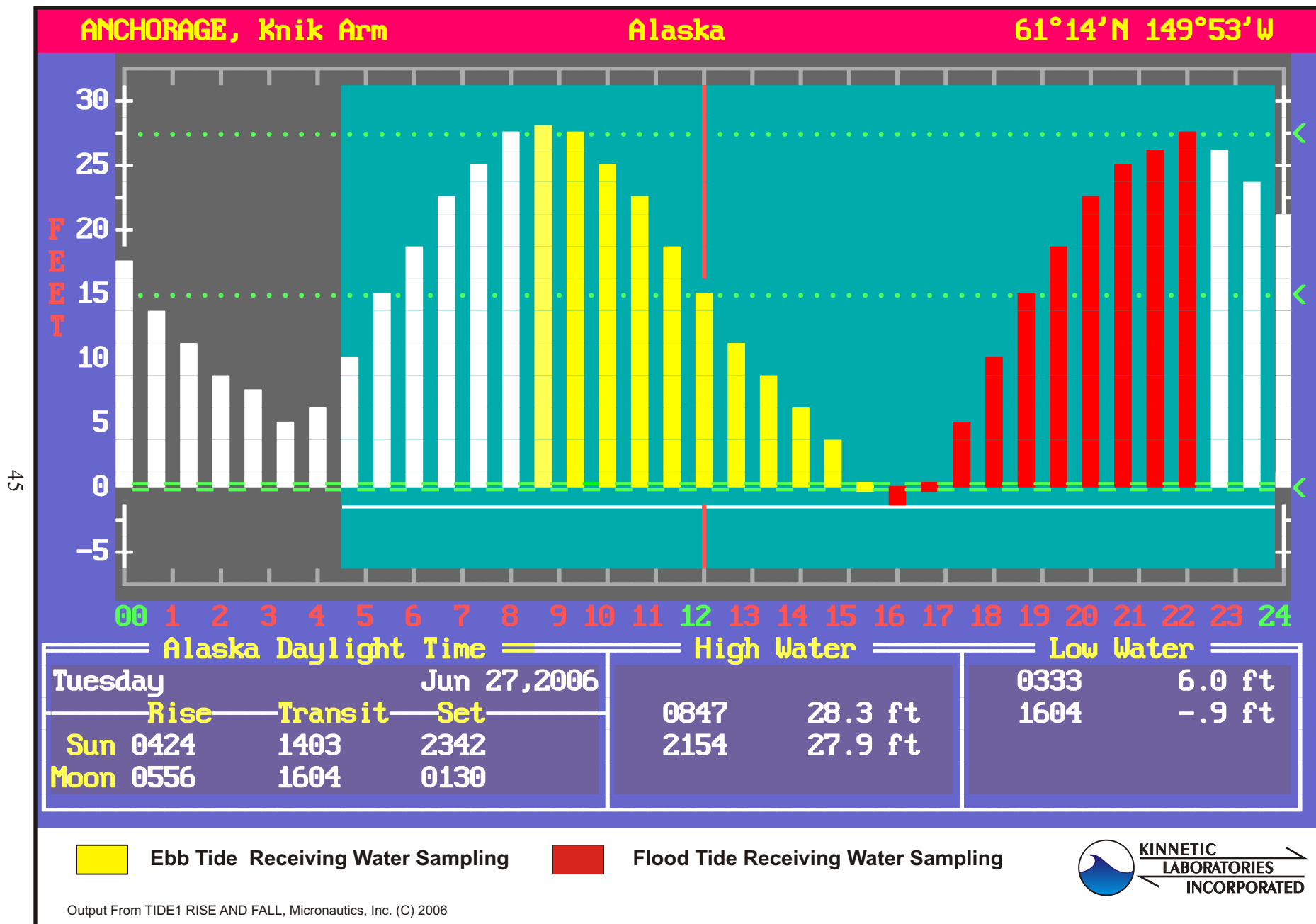
<sup>c</sup> Beryllium emissions shall not exceed 10 grams per day. With a control efficiency of 0.9998 at the maximum sludge feed rate, a sludge concentration of 500 milligrams per dry kilogram of sludge will not result in a violation of the limit.

<sup>d</sup> Mercury emissions shall not exceed 3,200 grams per day. With a control efficiency of 0.0 at the maximum sludge feed rate, a sludge concentration of 9.63 milligrams per dry kilogram of sludge will not result in a violation of the limit.

<sup>e</sup> The June and August 2006 metals analysis was performed by a contract lab; Soil Control Lab of Watsonville, CA. June Hg MDL was 14 mg/kg; other metals 0.035 mg/kg. August Hg MDL was 7.9 mg/kg; other metals 0.079 mg/kg.

<sup>f</sup> October and December samples were analyzed by SGS- EPA 6020, Mercury by EPA 7471A methods.





**Figure 5. Tidal Information for Receiving Water Sampling, Ebb and Flood Tides.**

**Table 14. 2006 Drogue Tracking Information.**

DATE	STATION	TIDAL INFORMATION				DROGUE NO.	RELEASE TIME AFTER SLACK (HOURS:MINUTES)	DROGUE SPEED (CM/S)
		Slack Water (Alaska Daylight Time <sup>a</sup> ; Stage)	Direction	Range (Feet) <sup>b</sup>				
27 June 2006	ZID	0847	HIGH	EBB	29.2	E1	0:45	140
27 June 2006	ZID	0847	HIGH	EBB	29.2	E2	2:27	120
27 June 2006	ZID	0847	HIGH	EBB	29.2	E3	4:27	76
27 June 2006	ZID	1604	LOW	FLOOD	28.8	F1	0:01	49
27 June 2006	ZID	1604	LOW	FLOOD	28.8	F2	1:42	71
27 June 2006	ZID	1604	LOW	FLOOD	28.8	F3	3:41	144
28 June 2006	CONTROL	1634	LOW	FLOOD	28.2	C1	0:00	75
28 June 2006	CONTROL	1634	LOW	FLOOD	28.2	C2	2:01	195
28 June 2006	CONTROL	1634	LOW	FLOOD	28.2	C3	4:11	226

<sup>a</sup> Tide1: Rise and Fall®, Micronautics, Inc. 2006. (Knik Arm, Anchorage)

<sup>b</sup> Predicted water level variations during tide.

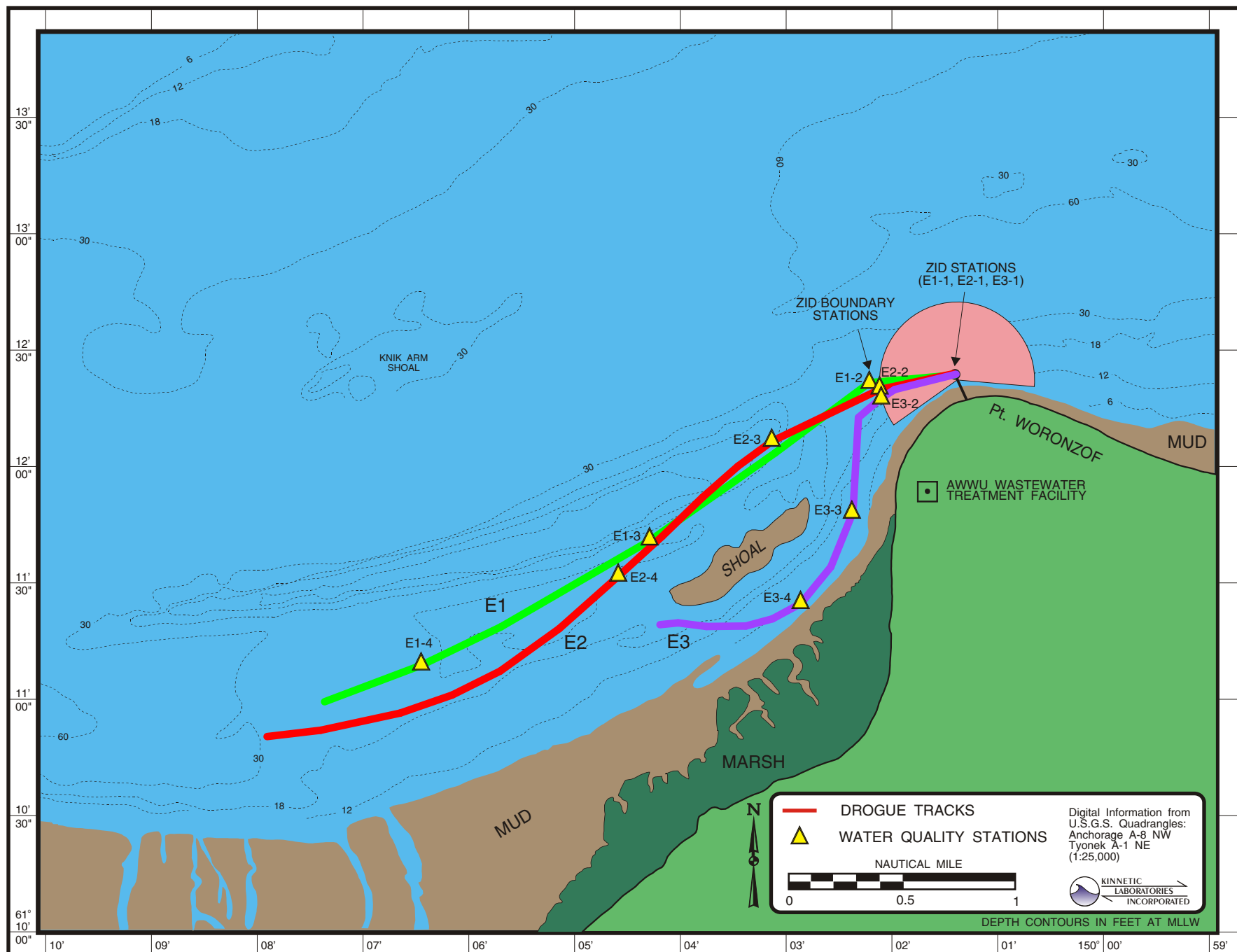


Figure 6. Summary of Ebb Drogue Tracks and Receiving Water Sampling Locations at Point Woronzof, 27 June 2006.

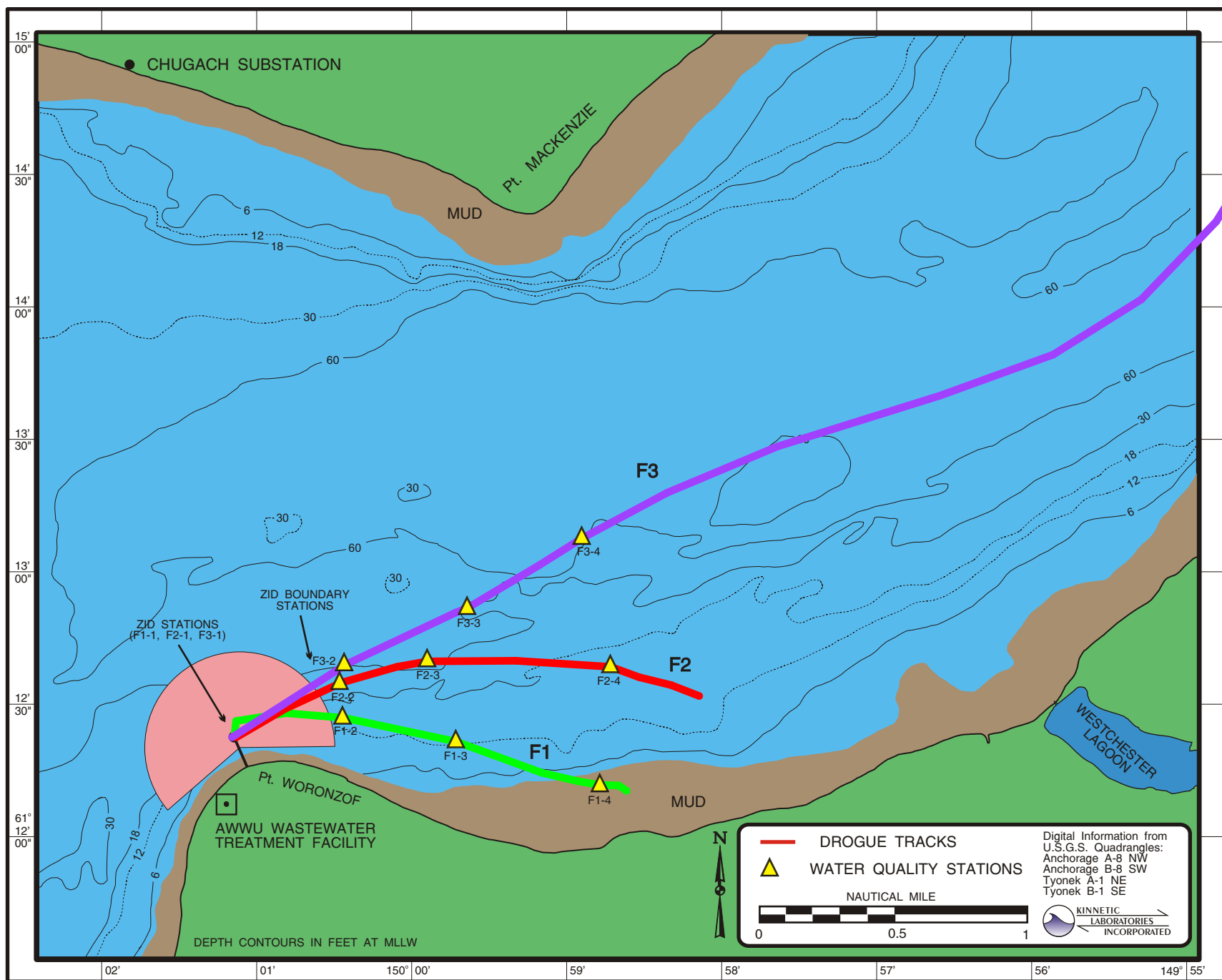


Figure 7. Summary of Flood Drogue Tracks and Receiving Water Sampling Locations at Point Woronzof, 27 June 2006.

lee side of Point Woronzof for approximately 1½ nautical miles before entering the shallow intertidal area where it was retrieved. The drogue traveled at an average speed of approximately 49 cm/s. The second flood drogue (F2) was deployed at 17:46 ADT, just under 1 hour 45 minutes after low slack. This drogue was transported initially to the northeast then easterly and further offshore than the first drogue for about 2 nautical miles at an average speed of 71 cm/s before it was recovered at 18:53 ADT.

The third flood drogue (F3) was deployed at 19:45 ADT, just under 4 hours after low slack water, and tracked for about 1½ hours until recovery at 21:14 ADT. The third drogue traveled in a northeast direction as had the second drogue for more than a mile, then moved further out from the shoreline, where it continued moving northeast in the central Knik Arm Channel with an average speed of 144 cm/s. This drogue was tracked for approximately 5 nautical miles and was recovered offshore and to the west of the Port of Anchorage in mid-channel.

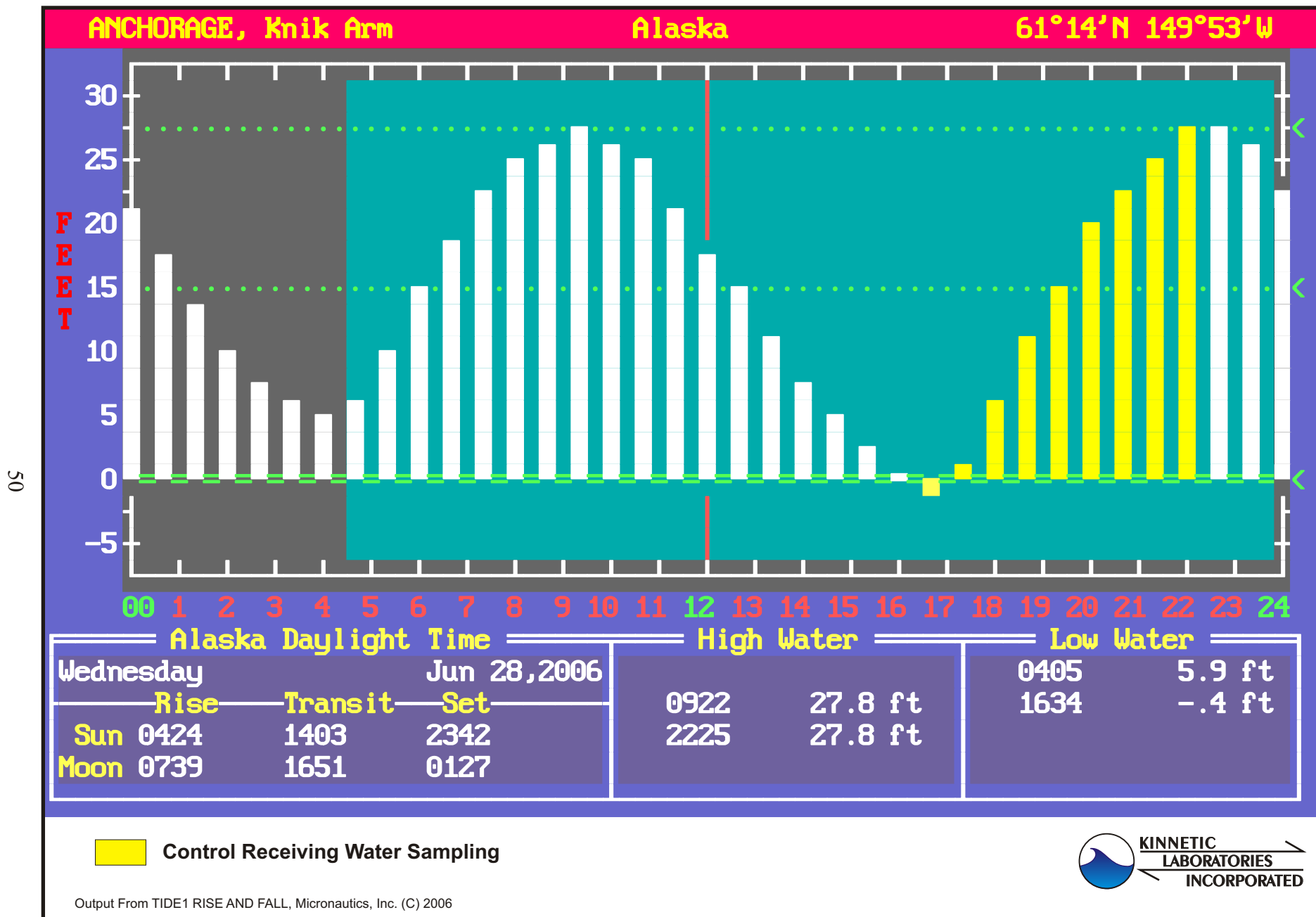
### **Control Site**

The Point MacKenzie control drogues were deployed and tracked on 28 June 2006. The predicted tidal range during the flood tide was 28.2 ft. Tidal information is provided in Figure 8 and Table 14 (Micronautics, Inc. Tide 1: Rise and Fall®, 2006). A composite of the three drogue trajectories is presented in Figure 9.

All three control drogues had similar tracks with the first drogue (C1) tracking closer to shore. The first drogue was released at 16:34 ADT, right at slack water, and traveled to the east and then to the northeast. After traveling approximately 2½ nautical miles, the drogue became grounded near the Pt. MacKenzie commercial dock. This drogue had an average speed of 75 cm/sec over the entire track was retrieved at 18:17 ADT. The second drogue (C2) was released at 18:35 ADT, 2 hours into the flood tidal cycle, and tracked until recovery at 19:38 ADT. This drogue had an average speed of 195 cm/s over the entire track and moved towards the northeast offshore of the first drogue, more in mid-channel and more northerly after passing Cairn Point traveling approximately 4 nautical miles. The third control drogue (C3) was released at 20:05 ADT, just over 4 hours after high slack water. The drogue traveled in a manner similar to the second drogue, moving northeast into the central channel with an average speed of 226 cm/s. Abreast of Cairn Point, the drogue turned more toward the north for the last part of its trajectory, traveling over 4½ nautical miles in all.

### **Summary of Water Quality Data**

The summer water quality sampling for all analysis types was conducted concurrently with the drogue tracking studies on 27 - 28 June 2006. As discussed previously, three drogues were released at the ZID for both ebb and flood tides and three were released at the control site for the flood tide. Water samples and CTD measurements were to be obtained at four stations along each drogue's track prior to its grounding or being retrieved. In the current NPDES permit, the ZID boundary is located 650 m distance from the outfall diffuser. To accomplish the ZID site sampling, the vessel was positioned directly upcurrent from the diffuser and allowed to drift down across it. Upon reaching the outfall diffuser, the drogue was dropped and the within-ZID station sampled. The distance from the outfall diffuser was monitored with the DGPS, and upon reaching 650 m distance from the diffuser, the ZID-boundary station was sampled. The third and fourth stations were then sampled along the drogue's path. Due to high current speeds, anchoring the vessel and sampling at each station was not practical or desirable for this type of sampling.



**Figure 8. Tidal Information for Receiving Water Sampling, Control Tide.**

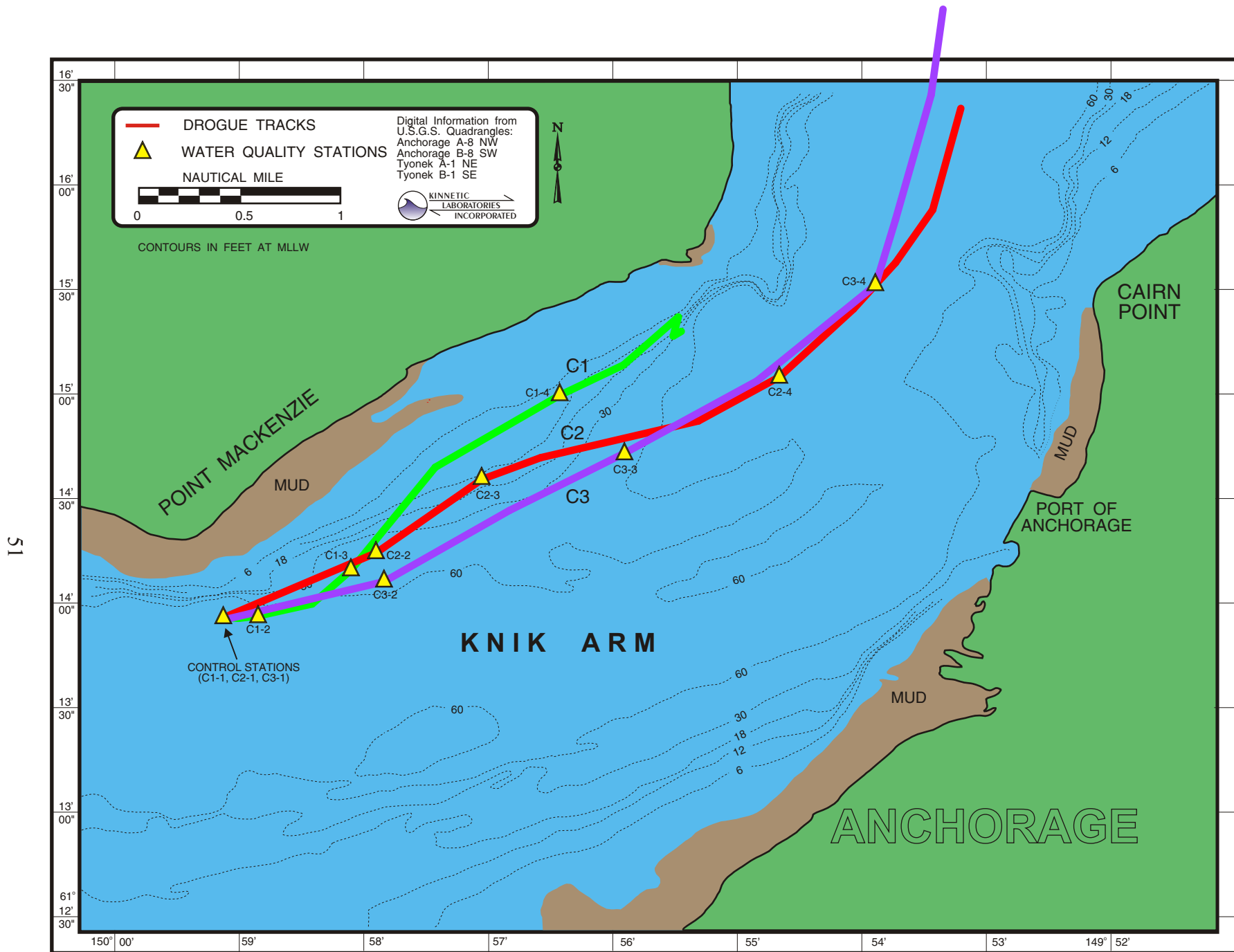


Figure 9. Summary of Control Drogue Tracks and Receiving Water Sampling Locations at Point MacKenzie, 28 June 2006.

Table 15 provides a summary of the water quality measurements obtained, where the station designation is represented by: drogue drop location (C=control, E=ebb, and F=flood), the first number represents the drogue number, and the second number represents the station along the drogue's path. The final character represents surface (S), mid-depth (M), or bottom (B) sample.

The waters of the inlet are extremely well-mixed both vertically and horizontally, as indicated by the CTD data. During the survey, temperatures ranged from a minimum of 11.99°C to a maximum of 13.81°C. Salinities were found to vary from a minimum of 11.05 parts per thousand practical salinity units (psu) to a maximum of 15.33 psu. Salinities were generally found to increase slightly during the flood and decrease on the ebb, as is typical for estuaries. As has been seen often times in the past, the control stations were found to be slightly warmer and less saline due to a greater influence from river runoff. Values for pH ranged from 7.39 to 8.10 with little to no vertical stratification. Values for DO collected in-situ by the CTD ranged from 7.12 to 10.43 mg/L with most concentrations being at saturation.

Representative hydrographic profiles of water quality are presented for a ZID boundary station during flood tide, Station E3-2, and a typical station from the third control drogue drop, Station C2-2 (Figure 10). The water column was found to be well-mixed from the surface to the bottom at all stations. Refer to Appendix D9 for hydrographic profiles from each water quality station.

Surface samples were obtained at each station for the analysis of color, TRC, and fecal coliform bacteria. Color values ranged from <5 to 10 color units on the platinum-cobalt scale with only two stations, E1-4 and E3-1 showing color values of 10 units. The AWQS for color is 15 color units.

With the exception of two stations located within the ZID, F1-1 and F2-1, all TRC concentrations were below the MDL of 0.010 mg/L. TRC concentrations were 0.023 at Station F1-1 and 0.11 mg/L at F2-1. It should be noted that the lowest MDL achievable in seawater for TRC analysis is higher than the State-specified limit of 0.002 mg/L (for salmonid fish) and at the limit of 0.01 mg/L for other marine species. The amperometric method that was used for the receiving water sampling is the preferred method since it is affected little by common oxidizing agents, temperature, turbidity, or color, but all TRC methods are subject to positive interferences in estuarine or marine waters. The average TRC concentrations of the effluent, collected every three hours for the sampling dates 27 and 28 June 2006 were 0.13 and 0.19 mg/L, respectively.

Fecal coliform values this year were quite low and ranged from <2 to 2 FC MPN/100 mL. More than half of the fecal coliform concentrations were reported at <2; this included 13 out of 24 samples at the ebb and flood stations combined and 12 out of 16 samples at the control stations. The overall median for fecal coliform samples at all outfall stations (both ebb and flood) was 2.0 FC MPN/100 mL; the median at the control stations was also 2.0 FC MPN/100 mL.

Turbidity values for water samples collected during the monitoring ranged from a low of 84 Nephelometric Turbidity Units (NTU) to a high of 577 NTU.

In addition to routine monitoring conducted at each water quality station, supplemental surface samples were collected from the first three stations along the first drogue trajectory for the ZID and control floods. A sample of final effluent was also obtained at the same time for comparison. Supplemental samples were analyzed for polycyclic aromatic hydrocarbons (PAHs), dissolved and total recoverable trace metals, cyanide, and TSS.



**Table 15. Hydrographic and Water Quality Data, 27 and 28 June 2006.**

Station Number	Time (ADT)	Latitude (North)	Longitude (West)	Depth (M)	Temp <sup>b</sup> (°C)	Salinity <sup>b</sup> (‰)	pH <sup>b</sup> (units)	D.O. <sup>b</sup> (mg/L)	Turbidity (NTU)	Color (units)	TRC (mg/L)	Fecal Coliform <sup>a</sup>
<b>JUNE 27</b>												
E1-1S	0932	61° 12.338'	150° 01.287'	0.5	NA	NA	NA	NA	381	<5	<0.010	<2
-1M				5.5	NA	NA	NA	NA	411			
-1B				11.0	NA	NA	NA	NA	491			
E1-2S	0942	61° 12.306'	150° 02.092'	0.5	12.21	14.77	7.93	7.18	308/331	<5	<0.010	2
-2M				7.0	12.12	14.97	8.08	8.07	420			
-2B				13.5	12.11	14.98	8.10	8.19	484			
E1-3S	1010	61° 11.639'	150° 04.154'	0.5	12.26	15.14	7.88	7.15	246	<5	<0.010	2
-3M				7.0	12.10	15.24	8.06	8.06	369			
-3B				13.5	12.03	15.14	8.08	8.17	326			
E1-4S	1036	61° 11.107'	150° 06.306'	0.5	12.16	14.99	7.93	7.58	264	10	<0.010	2
-4M				7.5	12.03	15.32	7.99	8.42	330			
-4B				14.5	11.99	15.33	8.01	8.75	320			
E2-1S	1114	61° 12.344'	150° 01.294'	0.5	12.38	13.90	7.93	8.25	418	5	<0.010	2
-1M				4.0	12.38	13.92	7.93	8.53	436			
-1B				7.5	12.38	13.92	7.93	9.61	425			
E2-2S	1120	61° 12.278'	150° 01.991'	0.5	12.39	13.91	7.92	7.61	439	<5	<0.010	2
-2M				6.0	12.38	13.91	7.93	7.79	424			
-2B				11.5	12.37	13.92	7.95	8.75	443/439			
E2-3S	1128	61° 12.058'	150° 03.012'	0.5	12.39	13.99	7.88	7.26	315	<5	<0.010	<2
-3M				5.5	12.39	14.00	7.90	7.76	391			
-3B				10.5	12.38	14.01	7.91	9.15	411			

**Table 15. Hydrographic and Water Quality Data, 27 and 28 June 2006. (continued)**

Station Number	Time (ADT)	Latitude (North)	Longitude (West)	Depth (M)	Temp <sup>b</sup> (°C)	Salinity <sup>b</sup> (‰)	pH <sup>b</sup> (units)	D.O. <sup>b</sup> (mg/L)	Turbidity (NTU)	Color (units)	TRC (mg/L)	Fecal Coliform <sup>a</sup>
E2-4S	1154	61° 11.485'	150° 04.456'	0.5	12.41	14.07	7.87	7.12	354	<5/<5	<0.010	2
-4M				5.5	12.37	14.11	7.89	7.91	396			
-4B				11.0	12.36	14.13	7.90	9.27	427			
E3-1S	1314	61° 12.342'	150° 01.276'	0.5	12.63	12.92	7.81	8.93	408	10	<0.010	<2
-1M				2.0	12.62	12.94	7.82	8.90	420			
-1B				3.5	12.62	12.94	7.82	9.55	413			
E3-2S	1324	61° 12.241'	150° 01.981'	0.5	12.64	12.88	7.82	7.29	268	5	<0.010/<0.010	2
-2M				4.5	12.59	12.90	7.83	7.53	393			
-2B				9.0	12.60	12.91	7.84	9.33	433			
E3-3S	1352	61° 11.758'	150° 02.245'	0.5	12.65	12.88	7.81	8.67	365	<5	<0.010	2
-3M				3.0	12.63	12.89	7.81	9.10	408			
-3B				6.0	12.63	12.89	7.81	9.67	444/459			
E3-4S	1411	61° 11.372'	150° 02.731'	0.5	12.69	12.89	7.81	8.41	362	<5	<0.010	<2
-4M				2.0	12.67	12.90	7.81	8.77	445			
-4B				3.5	12.66	12.91	7.81	9.40	499			
F1-1S	1603	61° 12.340'	150° 01.301'	0.5	NA	NA	NA	NA	234	<5	0.023/0.023	<2
-1M				1.5	NA	NA	NA	NA	250			
-1B				3.0	NA	NA	NA	NA	271/288			
F1-2S	1635	61° 12.441'	150° 00.589'	0.5	13.19	12.30	7.78	9.41	245	<5	<0.010	<2
-2M				1.5	13.15	12.31	7.79	9.50	286			
-2B				3.0	13.13	12.31	7.80	9.62	305			
F1-3S	1650	61° 12.358'	149° 59.939'	0.5	13.15	11.05	7.80	9.44	299	<5	<0.010	<2
-3M				1.5	13.14	11.95	7.76	9.18	319			
-3B				3.0	13.16	12.17	7.76	9.57	324			

**Table 15. Hydrographic and Water Quality Data, 27 and 28 June 2006. (continued)**

Station Number	Time (ADT)	Latitude (North)	Longitude (West)	Depth (M)	Temp <sup>b</sup> (°C)	Salinity <sup>b</sup> (‰)	pH <sup>b</sup> (units)	D.O. <sup>b</sup> (mg/L)	Turbidity (NTU)	Color (units)	TRC (mg/L)	Fecal Coliform <sup>a</sup>
F1-4S	1716	61° 12.172'	149° 58.954'	0.5	13.81	12.23	7.81	9.00	182	<5	<0.010	<2
-4M				1.5	13.81	12.23	7.81	9.06	210			
-4B				2.5	13.80	12.23	7.81	9.31	229			
F2-1S	1746	61° 12.346'	150° 01.263'	0.5	13.27	13.40	7.74	9.80	450/453	<5	0.11	<2
-1M				2.5	13.24	13.37	7.74	10.17	449			
-1B				5.0	13.23	13.37	7.75	11.31	461			
F2-2S	1757	61° 12.551'	150° 00.582'	0.5	13.18	13.21	7.73	8.23	335	<5	<0.010	<2
-2M				4.5	13.12	13.21	7.74	9.27	466			
-2B				8.5	13.09	13.18	7.75	9.79	493			
F2-3S	1805	61° 12.632'	150° 00.025'	0.5	13.04	12.98	7.72	8.86	427	<5	<0.010	<2
-3M				5.5	13.00	12.96	7.72	9.42	549			
-3B				11.0	13.02	12.97	7.73	9.80	549			
F2-4S	1827	61° 12.610'	149° 58.842'	0.5	13.06	12.83	7.71	9.26	284	<5	<0.010	2
-4M				4.0	13.07	12.88	7.72	9.62	577/562			
-4B				7.5	13.11	12.84	7.72	9.97	573			
F3-1S	1945	61° 12.344'	150° 01.288'	0.5	12.75	13.91	7.69	9.46	358	<5	<0.010	2
-1M				4.5	12.74	13.92	7.69	9.97	366			
-1B				8.5	12.74	13.93	7.70	10.33	379			
F3-2S	1952	61° 12.344'	150° 00.550'	0.5	12.98	13.30	7.62	9.12	326	<5/<5	<0.010	<2
-2M				9.0	12.74	13.84	7.66	9.15	265			
-2B				17.5	12.70	13.79	7.68	9.97	400			
F3-3S	2002	61° 12.832'	150° 59.775'	0.5	12.96	13.14	7.63	8.77	317	<5	<0.010	2
-3M				8.0	12.64	13.80	7.63	9.13	441			
-3B				15.5	12.58	13.91	7.64	9.93	444/473			

**Table 15. Hydrographic and Water Quality Data, 27 and 28 June 2006. (continued)**

Station Number	Time (ADT)	Latitude (North)	Longitude (West)	Depth (M)	Temp <sup>b</sup> (°C)	Salinity <sup>b</sup> (‰)	pH <sup>b</sup> (units)	D.O. <sup>b</sup> (mg/L)	Turbidity (NTU)	Color (units)	TRC (mg/L)	Fecal Coliform <sup>a</sup>
F3-4S	2012	61° 13.094'	150° 59.029'	0.5	12.68	14.00	7.39	9.24	355	<5	<0.010/<0.010	<2
-4M				19.5	12.36	14.83	7.58	9.04	427			
-4B				38.5	12.36	14.84	7.60	9.89	392			
<b>JUNE 28</b>												
C1-1S	1634	61° 13.954'	149° 59.084'	0.5	13.78	11.44	7.57	8.18	106	<5	<0.010	<2
-1M				12.0	13.08	12.06	7.63	8.48	496			
-1B				22.5	12.86	11.36	7.65	8.81	558			
C1-2S	1650	61° 13.964'	149° 58.803'	0.5	13.48	11.38	7.58	8.35	138	<5	<0.010	2
-2M				9.5	12.87	11.22	7.63	8.45	384			
-2B				18.5	12.85	11.31	7.65	9.16	580			
C1-3S	1710	61° 14.180'	149° 58.057'	0.5	NA	NA	NA	NA	153/171	<5	<0.010	<2
-3M				6.0	NA	NA	NA	NA	206			
-3B				12.0	NA	NA	NA	NA	575			
C1-4S	1738	61° 15.018'	149° 56.380'	0.5	13.69	11.51	7.68	8.39	310	<5	<0.010	<2
-4M				2.5	13.68	11.50	7.68	8.50	298			
-4B				5.0	13.71	11.53	7.68	9.15	357			
C2-1S	1835	61° 13.950'	149° 59.095'	0.5	13.29	11.42	7.63	8.89	084	<5	<0.010	2
-1M				5.0	13.30	11.43	7.63	9.48	193			
-1B				9.5	13.22	11.65	7.63	9.80	353			
C2-2S(A)	1843	61° 14.266'	149° 57.856'	0.5	13.22	11.51	7.63	8.78	290	<5	<0.010	<2
-2S(B)	1843			0.5	13.30	11.45	7.63	9.00	257/260	<5	<0.010	<2
-2S(C)	1843			0.5	13.31	11.43	7.64	8.71	258	<5	<0.010	<2
-2M				4.0	13.17	11.56	7.63	8.95	301			
-2B				7.5	12.92	11.85	7.62	9.44	328			

**Table 15. Hydrographic and Water Quality Data, 27 and 28 June 2006. (continued)**

Station Number	Time (ADT)	Latitude (North)	Longitude (West)	Depth (M)	Temp <sup>b</sup> (°C)	Salinity <sup>b</sup> (‰)	pH <sup>b</sup> (units)	D.O. <sup>b</sup> (mg/L)	Turbidity (NTU)	Color (units)	TRC (mg/L)	Fecal Coliform <sup>a</sup>
C2-3S	1852	61° 14.618'	149° 57.006'	0.5	13.36	11.35	7.63	8.72	193	<5	<0.010	2
-3M				5.0	13.13	11.77	7.62	8.56	313			
-3B				10.0	12.90	11.86	7.62	9.51	400			
C2-4S	1914	61° 15.103'	149° 54.619'	0.5	13.25	11.90	7.50	8.63	274	<5	<0.010	<2
-4M				20.0	12.97	11.97	7.58	10.17	571			
-4B				39.5	12.98	11.59	7.58	9.68	575			
C3-1S(A)	2005	61° 13.944'	149° 59.083'	0.5	13.21	12.80	7.49	9.21	416	<5	<0.010	2
-1S(B)	2005			---	---	---	---	---	452	<5		<2
-1S(C)	2005			---	---	---	---	---	465	<5		<2
-1M				11.5	13.21	12.79	7.58	9.96	393			
-1B				22.5	13.05	12.87	7.59	10.43	406/409			
C3-2S	2014	61° 14.129'	149° 57.790'	0.5	13.17	12.82	7.57	8.66	388	5	<0.010	<2
-2M				7.0	13.22	12.81	7.58	9.41	448			
-2B				14.0	13.07	12.77	7.58	10.09	485			
C3-3S	2025	61° 14.743'	149° 55.861'	0.5	13.16	12.84	7.53	8.67	393	5	<0.010	<2
-3M				15.5	13.09	12.86	7.57	9.88	433			
-3B				30.5	13.05	12.85	7.57	10.12	445			
C3-4S	2040	61° 15.542'	149° 53.847'	0.5	13.04	11.54	7.48	9.23	417	<5	<0.010/<0.010	<2
-4M				25.0	13.04	12.70	7.55	7.92	441/452			
-4B				49.5	12.94	12.46	7.57	9.04	515			

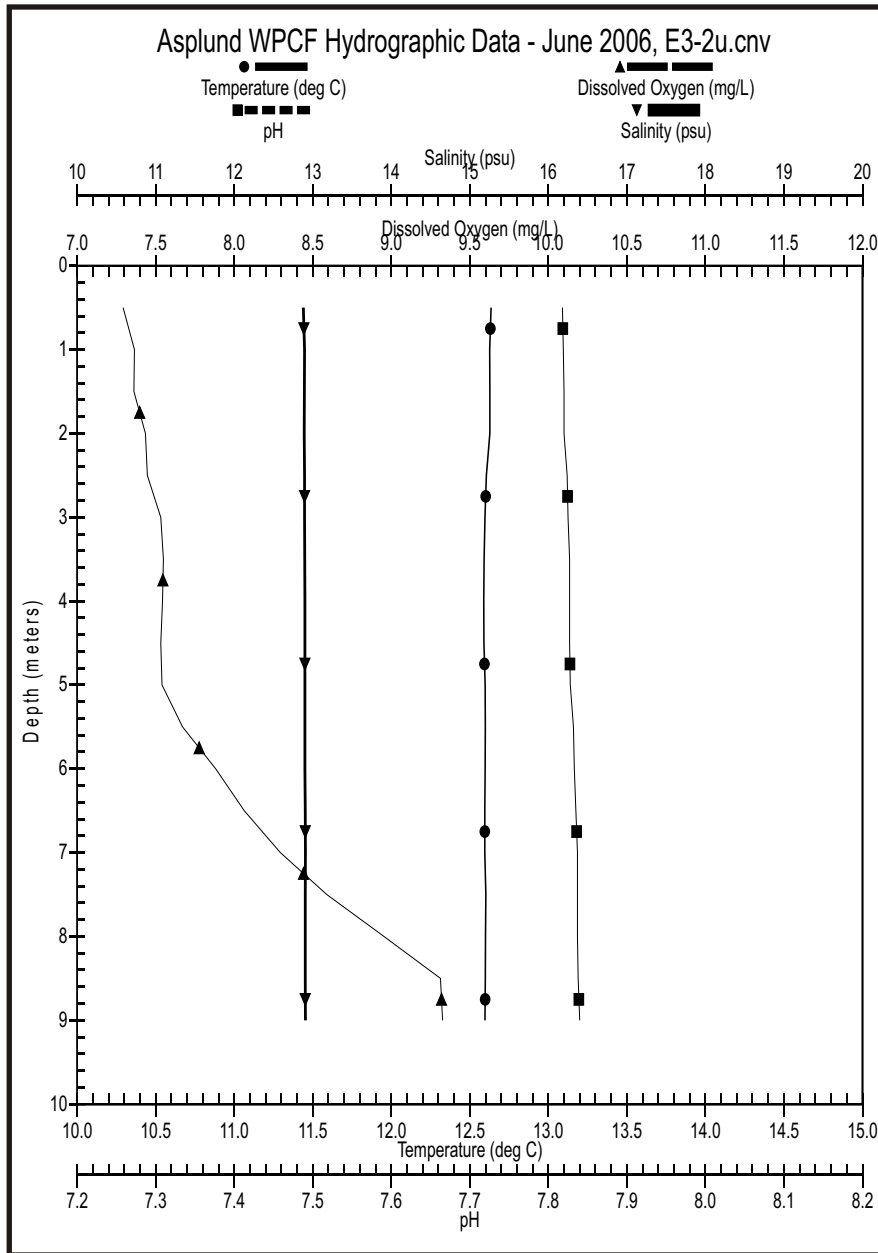
<sup>a</sup> Fecal coliform reported as MPN/100 mL.

<sup>b</sup> Values from CTD for 0.5 m depth taken as close to surface as possible.

NA Not available; CTD malfunction.

--- Samples not collected.

### Outfall Station



### Control Station

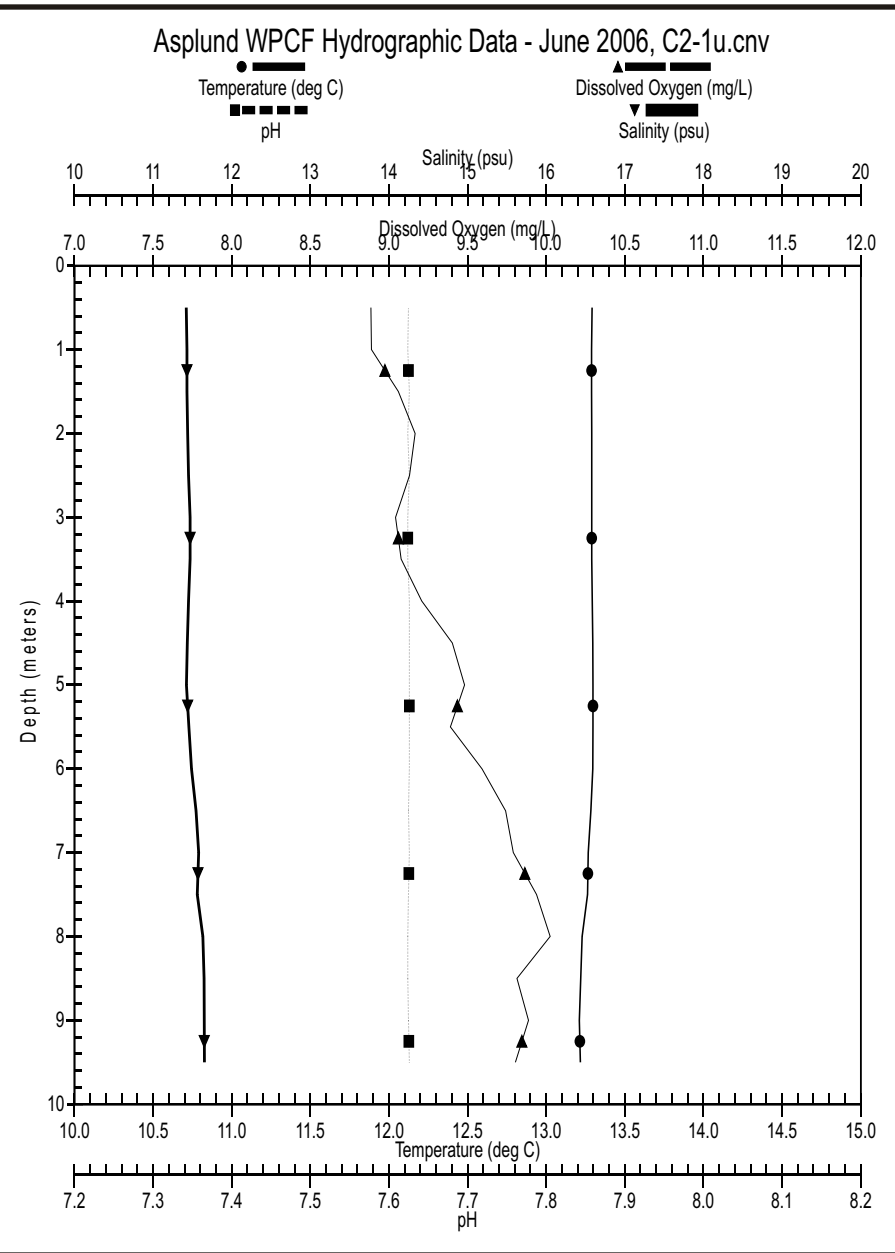


Figure 10. Sample Hydrographic Profiles from Outfall and Control Stations, June 2006.

The maximum dissolved arsenic, cadmium, copper, mercury, and lead concentrations were seen at nearfield Station F1-2 (Table 16). The highest dissolved chromium and nickel concentrations were seen at Station F1-1 located at low slack water above the diffuser, within the ZID. The highest dissolved silver concentration was seen at the control station, C1-3, while the highest dissolved zinc concentration was found at station F1-3. All dissolved metals concentrations met water quality criteria as they were considerably less than the State of Alaska SSWQC for the Point Woronzof area.

Total metals concentrations were also quite variable and differences between the outfall and control sites did not appear to exist that could be attributed to the discharge but were the result of differences in TSS concentrations. Station F1-3 was found to have the highest concentrations for all metals as tested by total recoverable methodology. Total suspended solid results ranged from 100 to 220 mg/L at the control stations compared to 250 to 340 mg/L at the outfall stations. The effluent sample had a TSS concentration of 43 and 48 mg/L, which included a field duplicate.

Cyanide concentrations were found to be either low or below the method detection limit of 0.10 µg/L at all receiving water stations. Cyanide was not detected in the water samples from Stations F1-3 and C1-1. All stations met the AWQS of 1 µg/L. The cyanide concentration in the effluent sample collected in conjunction with the receiving water sampling was 0.39 µg/L, still well below the AWQS of 1 µg/L, even without taking into account the mixing zone dilution.

Hydrocarbon analyses results are presented in Table 17. Total aromatic hydrocarbons (TAH) as BETX (EPA Method 602 samples from the concurrent summer dry sampling) was determined by summing benzene, ethylbenzene, toluene, and total xylenes. For values reported as ND, the reporting limit was used in the summation. Total aromatic hydrocarbons at the water quality stations were all ND, or less than 2.0 µg/L with the exception of station F1-1 which had a concentration of 3.3 µg/L. Concentrations of TAH were below the receiving water standard of 10 µg/L at all stations, including both outfall and control stations. The effluent sample had a TAH concentration of 32.23 µg/L, significantly less than the MAEC of 1,810 µg/L.

All concentrations of individual PAHs were summed and reported as total PAHs (TPAH) in Table 17. The TPAH values ranged from 0.020 to 0.049 µg/L at the control stations and from 0.031 to 0.133 µg/L at the outfall stations. The highest TPAH was seen at Station F1-2. The TPAH concentration in the effluent sample was 7.29 µg/L.

Total aqueous hydrocarbons (TAqH) as determined by PAHs plus BETX were calculated for the six stations and effluent, with the contribution from BETX assumed to be 2 µg/L (the sum of the individual detection limits for each ND compound; Table 17). Concentrations of TAqH were below the receiving water standard of 15 µg/L at all stations, including both outfall and control stations. Control stations ranged in TAqH from 2.02 to 2.05 µg/L, while outfall station TAqH concentrations ranged from 1.89 to 3.33 µg/L. The concentration of TAqH in the effluent was estimated at 39.52 µg/L, compared to the MAEC of 2,715 µg/L.

### **3.2.2 Intertidal Zone and Stream Bacterial Sampling**

Intertidal zone and stream bacteriological sampling was performed on 27 June 2006 (Table 18). Refer to Figure 3 for a map of the station locations. Intertidal zone sampling began approximately 1 hour prior to high tide at 20:12 ADT and was completed at 21:18 ADT. Two

**Table 16. Concentrations of Dissolved Metals, Total Recoverable Metals, Cyanide, and Total Suspended Solids in Receiving Water and Effluent Samples.** Values have not been blank corrected.

Station	Arsenic	Cadmium	Cyanide	Chromium	Copper	Mercury	Nickel	Lead	Silver	Zinc	TSS
	µg/L					ng/L	µg/L				mg/L
Dissolved Metals											
F1-1S (WITHIN ZID) <sup>a</sup>	1.55/1.48	0.0633	NA	0.425	1.11	0.707	1.07	0.00541	0.0101	0.623	NA
F1-2S (ZID BOUNDARY)	1.59	0.0655	NA	0.195	1.48	0.756	1.03	0.00676	0.0104	0.658	NA
F1-3S (NEAR FIELD)	1.4	0.0547	NA	0.225	0.968	0.415	0.943	0.00591	0.00720	0.808	NA
C1-1S (CONTROL)	1.40	0.0609	NA	0.227	1.08	0.598	1.05	0.00605	0.0110	0.499	NA
C1-2S (CONTROL)	1.40	0.0629	NA	0.225	1.07	0.749	1.05	0.00426	0.00900	0.775	NA
C1-3S (CONTROL)	1.44	0.06	NA	0.211	1.07	0.631	1.02	0.00627	0.0119	0.606	NA
EFFLUENT	1.47	0.157	NA	2.49	21.0	4.74	3.81	0.405	0.181	35.1	NA
DETECTION LIMIT	0.029	0.003	NA	0.058	0.005	0.12	0.011	0.004	0.002	0.015	NA
Total Metals											
F1-1S (WITHIN ZID) <sup>a</sup>	6.73	0.105	0.11/0.12	10.8	14.8	21.1/20.3	11.6	3.02	0.0508	26.5	250
F1-2S (ZID BOUNDARY)	9.6	0.124	0.39	14.9	21.1	32.0	16.2	4.54	0.0806	37.4	340
F1-3S (NEAR FIELD)	11.4	0.131/ 0.131	ND	18.0/18.3	26.1/26.5	40.8	19.3/19.6	5.96/5.91	0.0947/ 0.0923	45.4/46.3	290
C1-1S (CONTROL)	3.8	0.0857	ND	5.25	7.45	11.3	6.09	1.47	0.0322	12.9	110
C1-2S (CONTROL) <sup>a,b</sup>	3.57	0.0813	ND/0.18	5.00	6.95	9.20	5.74	1.32	0.0291	12.0	110/100
C1-3S (CONTROL)	7.06	0.105	0.17	11.3	15.4	22.8	12.1	3.42	0.0560	28.6	220
EFFLUENT	1.66	0.351	0.39	3.50	42.7	81.3	4.29	3.24	2.95	80.0	43/48
DETECTION LIMIT	0.029	0.004	0.10	0.0392	0.015	NA	0.005	0.005	0.006	0.011	0.10

<sup>a</sup> Field sample value/lab duplicate value (where applicable)

<sup>b</sup> Field sample value/field duplicate value (where applicable)

NA Not applicable

ND None detected



**Table 17. Supplemental Receiving Water and Effluent Hydrocarbon Analyses.**

PARAMETER	CONTROL FLOOD SAMPLES			ZID FLOOD SAMPLES			EFFLUENT
	C1-1S	C1-2S	C1-3S	F1-1S	F1-2S <sup>a</sup>	F1-3S	
<b>Volatile Organics (EPA 602) in µg/L with reporting limit in parenthesis if ND</b>							
Benzene	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)/ 0.41 J	ND (0.5)	0.43 J
Toluene	ND (0.5)	ND (0.5)	ND (0.5)	1.3	ND (0.5)/ 0.35 J	ND (0.5)	11
Ethylbenzene	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)/ ND (0.5)	ND (0.5)	3.8
Xylenes (Total)	ND (0.5)	ND (0.5)	ND (0.5)	1.0	ND (0.5)/ ND (0.5)	ND (0.5)	17
Total Aromatics (as BETX)	ND	ND	ND	3.3	ND/1.76 J	ND	32.23
<b>Polynuclear Aromatic Hydrocarbons (PAH) by GC/MS in µg/L</b>							
TPAH without perylene	0.020	0.028	0.049	0.031	0.133	0.038	7.288
<b>Total Aqueous Hydrocarbons (TAqH) in µg/L</b>							
TAqH <sup>b</sup>	2.02	2.03	2.05	3.33	2.13/1.89	2.04	39.52

<sup>a</sup> Duplicate field sample analysis provided (value/duplicate value)

<sup>b</sup> Defined by the State of Alaska as BETX analyte values from EPA Method 602 plus PAH analyte values from EPA Method 610 analysis; these calculated values include the full suite of PAH analyte values from GERG SOP 8901/9733 not analyte values from EPA method 610

ND None detected

J Estimated value. Result is less than reporting limits.

replicates were taken at all intertidal stations. Stream sampling was conducted from 13:28 to 14:04 ADT on 27 June 2006. In addition, an effluent sample was collected at the plant at 15:00 ADT on this date.

Fecal coliform concentrations in the intertidal were very low this year and ranged from <2.0 to 4 FC MPN/100 mL. The highest fecal concentrations (4 FC MPN/100 mL) were seen at the second replicate at Station IT-4, 250 m east of the diffuser, and the second replicate at Station IT-C, located across the Inlet near Point MacKenzie. Fecal coliform concentrations found in Fish, Chester, and Ship Creeks were higher than those seen in 2005, ranging from below 2.0 FC MPN/100 mL in the second replicate at Ship Creek to 240 FC MPN/100 in the second replicate collected from Fish Creek. The replicate plant effluent samples taken on the same day showed fecal concentrations of 500 and >1600 FC MPN/100 mL.

**Table 18. Summary of Bacterial Analyses, 27 June 2006.**

<b>Station and Replicate</b>	<b>Sample Time (ADT)</b>	<b>Fecal Coliform MPN/100 mL</b>
IT-1 Replicate 1	2045	<2
IT-1 Replicate 2	2045	2
IT-2 Replicate 1	2039	<2
IT-2 Replicate 2	2039	<2
IT-3 Replicate 1	2034	2
IT-3 Replicate 2	2034	<2
IT-4 Replicate 1	2030	<2
IT-4 Replicate 2	2030	4
IT-5 Replicate 1	2025	2
IT-5 Replicate 2	2025	<2
IT-6 Replicate 1	2020	<2
IT-6 Replicate 2	2020	2
IT-7 Replicate 1	2012	<2
IT-7 Replicate 2	2012	<2
IT-C Replicate 1	2118	2
IT-C Replicate 2	2118	4
Plant Effluent Rep. 1	1500	500
Plant Effluent Rep. 2	1500	>1600
Fish Creek Rep. 1	1404	110
Fish Creek Rep. 2	1404	240
Chester Creek Rep.1	1350	7
Chester Creek Rep.2	1350	13
Ship Creek Rep. 1	1328	4
Ship Creek Rep. 2	1328	<2

## **4.0 QUALITY ASSURANCE/QUALITY CONTROL**

### **4.1 OBJECTIVES**

The program includes a comprehensive quality assurance/quality control (QA/QC) program that encompasses all aspects of the project, from initial sample collection and field observation recording through laboratory analysis and data analysis to reporting. The objectives of the QA/QC program were to fully document the field and laboratory data collected, to maintain and document data quality, and to ensure that the data collected are of sufficient quality to be comparable with data collected through other EPA-regulated NPDES programs. The program was designed to allow the data to be assessed by the following parameters:

- Precision
- Accuracy
- Comparability
- Representativeness
- Completeness.

These parameters were controlled by adhering to documented methods and procedures, by the analysis of quality control (QC) samples on a routine basis, through the use of laboratories with existing QA/QC plans, through data review and verification procedures, and through a comprehensive sample documentation program. Throughout the program, KLI coordinated with the subcontracting laboratories to ensure that their in-house QA/QC programs were being implemented to meet the required standards.

Quality control activities in the field included adherence to documented procedures, including those in the program workplan, and the comprehensive documentation of sample collection and sample identification information. Sample integrity and identification were ensured by a rigidly-enforced chain of custody program. The chain of custody procedure documents the handling of each sample from the time the sample was collected to the arrival of the sample at the laboratory.

Analytical methods in use on the program have been approved and documented by EPA. These methods were used as project-specific protocols to document and guide analytical procedures. Adherence to these documented procedures ensures that analytical results are properly obtained and reported.

### **4.2 FIELD QUALITY CONTROL**

Quality control activities in the field consisted of the following:

- adherence to documented procedures in the workplan
- cross-checking of field identifications, measurements, and recording to ensure consistency and accuracy
- comprehensive documentation of field observations, sample collection, and sample identification information.

Sampling procedures proposed for this project have been successfully used for a number of years on the Asplund WPCF monitoring program. The use of documented and well-known procedures provides for greater likelihood of obtaining environmental samples uncontaminated by sampling procedures or apparatus. The use of project-specific field forms and data entry sheets also provide guidance for sampling procedures. Adherence to these procedures and use of these project documents helped ensure that data collected over the course of the project were comparable and accurate and that the study results are representative of conditions existing at the sampling sites.

#### **4.2.1 Documentation**

For observations made in the field, cross-checking between personnel were used as the primary method of quality control. These included, for example, review of navigational information recorded on the drogue field log. As described in Section 2.5, sample documentation began in the field using pre-printed log forms, labels, COC forms, and pre-determined sample identification numbers that were designed specifically for use on this project. This extensive field documentation provided a paper trail that exists for each sample or field observation and ensures credibility of the data. All field records were reviewed by the field crew leader as soon as possible after sampling was completed. Completed field logs were filed at the KLI Anchorage office upon return from the survey.

Sample integrity and identification were ensured by the COC program. The chain of custody procedure documented the handling of a sample from the time the sample was collected to the arrival of the sample at the laboratory. At the time of shipment, the field personnel kept a copy of the completed chain of custody form, and the original accompanied the samples to the laboratory.

#### **4.2.2 Sample Handling**

Samples were frozen, chilled, and/or preserved as required by the appropriate methods in the field and until receipt at the laboratory. Samples were packed in coolers along with the completed COC forms for shipment to analytical facilities as described in the Section 2.0. Coolers were securely packed with ice packs as required and sealed with signed and dated fiber tape for shipment.

#### **4.2.3 Navigation**

As described above, navigation was accomplished with a DGPS system. The accuracy of the DGPS coordinates were verified by positioning the vessel over the diffuser during a low slack tide when the boil was evident and comparing DGPS readings with the known outfall location. Intertidal stations were re-occupied using a hand-held DGPS, distance and bearings, and visual sightings to temporary benchmarks and landmarks. All station information was entered on the appropriate field logs and reviewed by the field leader.

#### **4.2.4 Field Instrumentation**

Field equipment used for collection, measurement, and testing was subject to a strict program of control, calibration, adjustment, and maintenance. Care was taken to ensure that the instruments used for field measurements of temperature, salinity, DO, and pH were calibrated and adjusted

with appropriate standards prior to and after each sampling event. The standards of calibration are in accordance with applicable criteria such as the U.S. Bureau of Standards, American Society of Testing and Materials (ASTM) Standards, and follow the instrumentation manufacturer's recommended procedures.

Temperature calibration was ensured by pre-calibration at the factory and field checks of the electronic temperature sensor against a research grade thermometer reading taken from the same sample at the same time. The electronic sensor for salinity (conductivity) was also pre-calibrated at the factory and field checked against six ambient water samples which were collected for the analysis of salinity (SM 2520B) to verify the proper operation of the probe. The DO probe was also pre-calibrated at the factory. For pH, the electronic sensor probe was pre-calibrated using three known buffer solutions.

#### **4.2.5 Sampling Variability**

Sampling variability was documented by sampling three replicates at one station for the water quality parameters. This included three replicate Niskin<sup>®</sup> bottle casts to obtain replicate turbidity samples and three replicate grabs at the surface for fecal coliform, color, and TRC analyses. In addition, triplicate casts of the CTD for pH, DO, temperature, and salinity were performed at one station in order to check reading variability from the probe's electronic sensors.

#### **4.2.6 Field Check Samples**

Field check samples include trip blanks for volatile organic analyses for EPA Methods 602 and 624, field blanks, field generated duplicates, and standard reference materials (SRMs), spikes or other samples of known concentration that may be sent to the laboratory. With the exception of the trip blanks which are initiated at the laboratory, most of these samples were sent to the laboratory as blind samples to ensure unbiased reporting of results.

### **4.3 LABORATORY QUALITY CONTROL**

Analytical quality control for this project included the following:

- adherence to documented procedures, particularly EPA methods, internal laboratory protocols, and respective laboratory QA/QC programs
- calibration of analytical instruments
- ability of each analytical laboratory to meet analytical precision, accuracy, limits of detection, and limits of quantification that meet EPA requirements
- use of quality control samples, internal standards, and surrogate solutions

The analytical laboratories used on this project operate under the quality assurance (QA) programs described in their QA management plans. These programs involve the participation of qualified and trained personnel; the use of standard operating procedures for analytical methodology and procedures; a rigorous system of documenting and validating measurements; maintenance and calibration of instruments; and the analysis of quality control samples for precision and accuracy tracking. The pertinent methods descriptions the laboratories are following are comprehensive and provide information concerning proper sample collection, processing, storage, and preservation; required apparatus and materials; analytical procedure;

standardization and calibration techniques; quality control samples required; methods of calculating values and assessing data quality; and reporting and performance criteria.

#### **4.3.1 Documentation**

Documentation in the laboratory included finalizing the original COC forms and generating the internal documents that track samples through the laboratory (e.g., sample control logs, refrigerator logs, etc.). Any deviations from the prescribed methods or internal laboratory standard operating procedures (SOPs) were documented in the project files. Data affected by such deviations were appropriately qualified, as was any data that did not meet acceptable quality criteria. Typical data qualifiers included those denoting estimated concentrations (J) or not detected (ND or U).

#### **4.3.2 Calibration**

Calibration is an integral part of any instrumental analysis. Calibration requirements for each type of analysis to be used on this project are described in the appropriate methods. Typically, instrument calibration was performed daily or on a per batch basis.

#### **4.3.3 Quality Control Procedures**

Internal laboratory quality control checks included the use of surrogate solutions and quality control samples such as procedural (or method) blanks, matrix spike/spike duplicates, standard reference materials (SRMs) or EPA QC check samples, and duplicates as specified in the EPA approved analytical procedures. Surrogate compounds were spiked into samples as appropriate to measure individual sample matrix effects that are associated with sample preparation and analysis. This includes QC samples such as procedural blanks and matrix spike samples. Surrogate compound analyses were reported in percent recovery. Results from quality control samples allow the assessment of quality assurance parameters such as accuracy and precision of the data. Any data falling outside the acceptable criteria as defined in the methods were appropriately investigated and qualified.

Method blanks are pure, organic- or metal-free reagent water that are run through the analysis process and used to verify that analyte concentrations are accurate and do not reflect contamination. Method blanks were analyzed as called for by each method, typically one per day or one per sample batch.

Laboratory accuracy was assessed by routine spiking of environmental samples with a standard addition as called for by the appropriate method. Sample spikes and matrix spike/matrix spike duplicates were run on the organic analyses collected as part of both the influent, effluent, and sludge and receiving water monitoring components of the program. These samples are fortified with components of interest following the initial analysis to check the ability of the method to recover acceptable levels and to determine accuracy of the data. Quality control charts are prepared by the laboratories where applicable to show the range of individual measurements encountered by following procedures such as those outlined in *Design of 301(h) Monitoring Programs for Municipal Wastewater Discharges to Marine Waters* (EPA, 1982b) and other guidance documents (e.g. EPA, 1994a and 1994b).

Trace metals analyses for the monitoring were supported through the use of standard reference materials (SRMs), which are quality control reference materials with known metals values that are obtained from the National Bureau of Standards and other sources. These SRMs were analyzed by the laboratory at the same time as the program samples in order to ensure laboratory accuracy. Results of the analyses of SRMs should fall within acceptable limits and can be expressed as percent recovery.

Analytical and instrument variability was checked by laboratory splitting of one larger-volume field sample per survey into triplicates and analyzing the subsamples for the various water quality parameters. The individual measurements and concentration ranges were reported for each parameter of each split. In addition, duplicate analyses of samples split in the laboratory were used as a means to assess laboratory precision.

For other water quality parameters, the following summary of QA/QC procedures will apply:

- Fecal Coliform Bacteria: *Escherichia coli* was used as a positive control for each analytical run. *Pseudomonas aeruginosa* was used as a negative control, and buffered dilution water was used as a blank. In addition, 10 % of the samples were run in duplicate.
- Enterococci Bacteria: *Streptococcus faecalis* was used as a positive control for each analytical run. *Escherichia coli* was used as a negative control, and buffered dilution water was used as a blank.
- Color: Fresh color standards were made prior to the beginning of the program. Samples were allowed to settle and were pre-treated with paper filtration to remove turbidity and reported as "true color".
- Turbidity: The instrument was calibrated with a 20.0 NTU standard provided by the manufacturer. Due to the high turbidity in Cook Inlet, all samples were run at the 10X scale on the nephelometer to ensure that the measured turbidities were within the range of the instrumentation. In addition, select samples were run in duplicate.
- Total Residual Chlorine: TRC was run by amperometric titration which requires a blank and laboratory control and laboratory control spike samples every ten samples. The amperometric titrant was standardized daily.
- Salinity: A seawater salinity standard was used to check the instrumental accuracy of the salinometer every half-hour or every ten samples whichever is more frequent.

#### **4.3.4 Method Detection Limits**

The method detection limits (MDLs), practical quantification limits (PQLs), or method reporting limits (MRLs) for the various analytes were determined using the appropriate method as described in the protocols. These MDLs, PQLs, and MRLs have been reported with the data (see appendices) and included in summary data tables as appropriate. Concentrations below the MDL, PQL, or MRL were typically qualified with the "ND" code for non-detect.

## **4.4 DATA REVIEW AND VALIDATION**

Data were verified by performing comparisons of final data against the original documentation, including the workplan, field logs and data sheets, and analytical reports. Any discrepancies were fully documented in the program files and reported in the annual report. Data were validated according to accuracy, precision, and completeness for both the field sample collection and analytical laboratory components of the program. Qualitative evaluation and statistical procedures were used to check the quality of the field and chemical data as appropriate. The primary goals of these review and validation procedures are to ensure that the data:

- are representative of conditions in the study area
- are accurate
- demonstrate the required level of precision
- are comparable with data from other NPDES programs
- are acceptable for use as a tool to evaluate permit compliance
- allow independent technical appraisal of the program's ability to meet the monitoring objectives.

Analytical data were subjected to review upon receipt from the laboratory following guidelines such as those published in *U.S. EPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review* (EPA 1994a), or *U.S. EPA Contract Laboratory Program National Functional Guidelines for Organic Data Review* (EPA 1994b). Items reviewed during data validation included sample holding times, results for laboratory method blanks, matrix spike/spike duplicates (MS/SD), check standards or SRMs, field and laboratory duplicates, field and trip blanks, report completeness, and laboratory performance (i.e., ability to achieve method detection limits and adherence to QA/QC criteria established for this program). Items failing to meet such validation and review procedures were noted and corrected, if possible. Items that could not be corrected and fell outside of acceptable limits (e.g., a sample analyzed outside holding time) have been noted in this annual report if they occur.

## **4.5 QUALITY ASSURANCE/QUALITY CONTROL RESULTS**

### **4.5.1 Field Instrumentation and Sampling Quality Control Results**

For influent, effluent, and sludge monitoring, field-generated duplicate influent and/or effluent samples were collected for the analysis of pesticides during the June 2006 sampling. During the August 2006 sampling, duplicate effluent samples were collected for metals (total and dissolved antimony, selenium, and thallium). Results for these duplicate analyses are provided in Table 9 and Table 10 and the appendices, and were found to be within acceptance limits. Results from duplicate field samples collected for certain parameters during the receiving water sampling such as volatile organics, metals, cyanide, turbidity, and TSS are reported in the appropriate tables (Table 15, Table 16, and Table 17), and were found to be within acceptance limits.

Field blanks were collected for several parameters during each sampling event by pouring HPLC-grade deionized (DI) water into the appropriate sampling containers with the correct preservative. Trip blanks consisted of DI blank samples prepared at the laboratory that went through the same shipping and handling procedures as all the other sample containers of each analytical type; these remained unopened in the field. Field blanks and trip blanks analyzed



using EPA Method 602 showed no measurable levels of the target compounds during the receiving water monitoring (Appendix D2). Trip blanks analyzed in conjunction with the EPA 624 analyses for June 2006 showed trace levels of bromodichloromethane, chloroform, and methylene chloride, while the trip blank for August 2006 showed trace levels of only methylene chloride (Appendices A3 and B3). Additionally, the field blanks analyzed in conjunction with the EPA 624 analyses for both June and August 2006 showed trace levels of methylene chloride. This compound was also detected in the influent and effluent for both sampling events and in the laboratory method blank during August. Methylene chloride is a common laboratory contaminant that often shows up in both field samples and laboratory blanks. Values reported for these parameters are qualified with the "B" qualifier to indicate laboratory contamination (Table 9 and Table 10).

Sampling variability for water quality parameters (fecal coliform bacteria, color, turbidity, and TRC) was determined by analyzing three surface samples taken at Station C2-2S (Table 19). Where appropriate, the mean, standard deviation, and coefficient of variation are included in Table 19 to provide a measure of variability for the listed parameters. The coefficient of variation for the various sample types was found to be 0 % for color and TRC and 7 % for turbidity.

Three replicate fecal coliform samples were also collected at Station C2-2. All three samples yielded the same result (<2 FC MPN/100 mL). Mean, standard deviation, and coefficient of variation are not determined for fecal coliform due to nature of the analysis which yields only a most probable number of bacteria per 100 mL. Instead, the  $\pm 95$  % confidence limits for each sample are typically provided. In this case, since all three samples had the same result, no confidence limits have been reported here.

Variability and calibration checks of the electronics probe were done by performing repeated profiles of temperature, pH, DO, and salinity at one station (C2-2). Results of these calibration checks for the Seabird CTD show that probe variability for temperature, pH, and salinity was extremely low and in all cases with a coefficient of variation of <0.42 % (Table 20). Probe variability for DO was slightly higher with a coefficient of variation of <2.5 %. Salinity data obtained from the CTD were compared with salinity grab samples to confirm that the instrument was within calibration. In addition, a precision thermometer was used to verify CTD temperature readings, and the pH sensor was calibrated against three standards prior to field deployment at KLI's laboratory facilities. The salinity, temperature, and pH probes were found to be accurate and within calibration during the survey.

#### **4.5.2 Laboratory Quality Control Results**

Full analytical data and laboratory case narratives are provided for each laboratory in the appendices. Laboratory duplicate analyses, where performed, were found to have a high degree of precision and were within the acceptance criteria for relative percent difference (RPD). Laboratory duplicates were performed for a number of organic analyses and were found to be within acceptance limits. A number of duplicate confirmation results, however, did exceed QC criteria and have been appropriately qualified in their respective tables. Six pesticides exceeded 40 % RPD between the primary and confirmation columns in the June 2006 influent, effluent, and sludge samples and two in the sludge samples during the August 2006 sampling event. All data were appropriately qualified.

**Table 19. Sampling and Laboratory Variability for Water Quality Samples, 27 and 28 June 2006.**

Station	Subsample Designation	Fecal Coliform* (MPN/100 mL)	Color (units)	Turbidity (NTU)	TRC (mg/L)
<b>SAMPLING VARIABILITY</b>					
C2-2S	A	<2[---]	<5	290	<0.010
	B	<2[---]	<5	257	<0.010
	C	<2[---]	<5	258	<0.010
Mean	---	---	<5	268	<0.010
Standard Deviation	---	---	0	18.77	0
Coefficient of Variation	---	---	0	7	0
<b>LABORATORY VARIABILITY</b>					
C3-1S	A	2[1-10]	<5	416	<0.010
	B	<2[---]	<5	452	NA
	C	<2[---]	<5	465	NA
Mean	---	---	<5	444	---
Standard Deviation	---	---	0	25.38	---
Coefficient of Variation	---	---	0	5.71	---
C1-3S	A	NA	NA	153	NA
	B	NA	NA	171	NA
Relative % Difference	---	---	---	11	---
C2-2S	A	NA	NA	257	NA
	B	NA	NA	260	NA
Relative % Difference	---	---	---	1	---
C3-1B	A	NA	NA	406	NA
	B	NA	NA	409	NA
Relative % Difference	---	---	---	1	---
C3-4S	A	NA	NA	NA	<0.010
	B	NA	NA	NA	<0.010
Relative % Difference	---	---	---	---	0
C3-4M	A	NA	NA	441	NA
	B	NA	NA	452	NA
Relative % Difference	---	---	---	2	---
E1-2S	A	NA	NA	308	NA
	B	NA	NA	331	NA
Relative % Difference	---	---	---	7	---
E2-4S	A	NA	<5	NA	NA
	B	NA	<5	NA	NA
Relative % Difference	---	---	0	---	---
E3-2S	A	NA	NA	NA	<0.010
	B	NA	NA	NA	<0.010
Relative % Difference	---	---	---	---	0
E3-3B	A	NA	NA	444	NA
	B	NA	NA	459	NA
Relative % Difference	---	---	---	3	---

**Table 19. Sampling and Laboratory Variability for Water Quality Samples, 27 and 28 June 2006. (continued)**

Station	Subsample Designation	Fecal Coliform* (MPN/100 mL)	Color (units)	Turbidity (NTU)	TRC (mg/L)
F1-1S	A	NA	NA	NA	0.023
	B	NA	NA	NA	0.023
Relative % Difference		---	---	---	0
F1-1B	A	NA	NA	271	NA
	B	NA	NA	288	NA
Relative % Difference		---	---	6	---
F2-1S	A	NA	NA	450	NA
	B	NA	NA	453	NA
Relative % Difference		---	---	1	---
F2-4M	A	NA	NA	577	NA
	B	NA	NA	562	NA
Relative % Difference		---	---	3	---
F3-2S	A	NA	<5	NA	NA
	B	NA	<5	NA	NA
Relative % Difference		---	0	---	---
F3-3B	A	NA	NA	444	NA
	B	NA	NA	473	NA
Relative % Difference		---	---	6	---
F3-4S	A	NA	NA	NA	<0.010
	B	NA	NA	NA	<0.010
Relative % Difference		---	---	---	0

\* 95% confidence intervals indicated in brackets (American Public Health Association, 1998. Standard Methods for the Examination of Water and Wastewater. 20th Edition. Washington, D.C. Table 9221.IV.)

NA Not analyzed

--- Not applicable

**Table 20. Seabird SEACAT SBE-19 CTD Probe Variability Check, 28 June 2006.**

Depth (m)	Temperature (°C)			Salinity (ppt)			pH (units)			DO (mg/l)			Mean (units)				Standard Deviation				Coeff. of Variation (%)			
C2-	2A	2B	2C	2A	2B	2C	2A	2B	2C	2A	2B	2C	Temp	Sal	pH	DO	Temp	Sal	pH	DO	Temp	Sal	pH	DO
0.5	13.22	13.30	13.31	11.51	11.45	11.43	7.63	7.63	7.64	8.78	9.00	8.71	13.28	11.46	7.63	8.83	0.050	0.042	0.005	0.147	0.38	0.37	0.06	1.67
1.0	13.21	13.27	13.30	11.52	11.47	11.44	7.63	7.63	7.64	8.82	8.98	8.70	13.26	11.47	7.63	8.83	0.050	0.040	0.005	0.140	0.37	0.35	0.06	1.59
1.5	13.20	13.27	13.29	11.52	11.47	11.45	7.63	7.63	7.64	8.89	8.96	8.72	13.25	11.48	7.63	8.86	0.049	0.037	0.005	0.127	0.37	0.32	0.07	1.43
2.0	13.18	13.26	13.28	11.54	11.48	11.46	7.63	7.63	7.63	8.95	9.03	8.71	13.24	11.49	7.63	8.90	0.052	0.038	0.003	0.171	0.40	0.33	0.04	1.92
2.5	13.19	13.24	13.26	11.53	11.49	11.48	7.63	7.63	7.63	8.99	8.85	8.65	13.23	11.50	7.63	8.83	0.040	0.028	0.003	0.173	0.30	0.25	0.03	1.96
3.0	13.19	13.22	13.24	11.53	11.51	11.50	7.63	7.63	7.63	9.10	8.82	8.66	13.22	11.51	7.63	8.86	0.024	0.015	0.003	0.222	0.18	0.13	0.03	2.50
3.5	13.19	13.19	13.20	11.54	11.53	11.53	7.63	7.63	7.63	9.13	8.91	8.71	13.19	11.54	7.63	8.92	0.008	0.002	0.002	0.210	0.06	0.02	0.03	2.35
4.0	13.17	13.17	13.17	11.56	11.55	11.56	7.63	7.63	7.63	8.95	9.01	8.74	13.17	11.56	7.63	8.90	0.005	0.007	0.002	0.142	0.04	0.06	0.02	1.60
4.5	13.16	13.15	13.15	11.56	11.58	11.58	7.63	7.63	7.63	8.91	9.00	8.80	13.15	11.57	7.63	8.90	0.008	0.012	0.001	0.099	0.06	0.10	0.02	1.12
5.0	13.16	13.13	13.14	11.57	11.62	11.60	7.63	7.63	7.63	8.98	9.07	8.93	13.14	11.59	7.63	8.99	0.018	0.026	0.001	0.073	0.13	0.22	0.02	0.82
5.5	13.15	13.08	13.12	11.60	11.68	11.64	7.63	7.62	7.63	9.07	9.20	9.11	13.12	11.64	7.62	9.12	0.033	0.044	0.002	0.065	0.25	0.37	0.03	0.72
6.0	13.09	13.03	13.07	11.67	11.77	11.73	7.62	7.62	7.63	9.13	9.22	9.36	13.06	11.72	7.62	9.24	0.032	0.050	0.003	0.117	0.25	0.42	0.03	1.26
6.5	13.01	12.94	12.94	11.77	11.84	11.85	7.62	7.62	7.62	9.29	9.47	9.47	12.96	11.82	7.62	9.41	0.038	0.043	0.001	0.102	0.29	0.36	0.01	1.08
7.0	12.94	12.91	12.90	11.83	11.86	11.86	7.62	7.62	7.62	9.34	9.52	9.49	12.92	11.85	7.62	9.45	0.022	0.016	0.001	0.093	0.17	0.13	0.01	0.98

In addition to the standard laboratory QC procedures, color, fecal coliform, and turbidity, samples collected at Station C3-1 during the receiving water sampling were split in the laboratory and analyzed in triplicate. Mean, standard deviation, and coefficient of variation are reported in Table 19 for these samples (where appropriate). These statistics were not determined for fecal coliform due to nature of the analysis which yields only a most probable number of bacteria per 100 mL. Instead, the  $\pm 95\%$  confidence limits for each sample are provided in Table 19. Fecal coliform values were within the confidence limits. Coefficient of variation was shown to be 0 for color and 5.71 for turbidity. For analyses where samples were run in duplicate, such as TRC, turbidity, and color samples, the relative percent difference between duplicates was calculated. Laboratory duplicate analyses were found to generally be very low and within acceptable limits. Duplicate results for turbidity ranged from <1 to 7 % RPD. Color duplicate results showed 0 % difference between duplicates. Duplicate TRC analyses were all identical to the original sample results at <0.010 mg/L, with the exception of Station F1-1S where both samples were found to have a concentration of 0.023 mg/L.

Laboratory accuracy was assessed through the use of surrogate recoveries, sample and control spikes and duplicates, and SRMs. Detailed QA/QC results for all contract laboratory analyses are provided in the appendices corresponding to each analysis. Surrogates are compounds that were added to each sample and QC sample that were analyzed by GC methodology, such as volatile organic compounds (EPA 602 and 624/8260B), semi-volatile organic compounds (EPA 625/8270C), pesticides (EPA 608/8081A and 614/8141A), and dioxins (EPA 8280A). Several instances of surrogate recoveries outside QC recovery limits were found during the 2006 sampling influent, effluent, and sludge monitoring effort. These deviations are discussed in the case narratives that were provided by each laboratory which fully detail all QC issues for both sampling events and explain any QC deviations; these are provided in report Appendices. As indicated by the laboratories, the data were not significantly affected by any QC issue.

Matrix spike (MS), matrix spike duplicate (MSD), laboratory control spike (LCS), and duplicate control spike (DCS) are samples and blanks that are spiked with target compounds of interest to determine percent recovery and relative percent difference between duplicates. The QC criteria include an acceptable recovery range and an RPD that should not be exceeded. Total metals, dissolved metals, cyanide, volatile organic compounds, and semi-volatile organic compounds met QC criteria for MS, MSD, LCS, and DSC with a few exceptions for all analyses on the program. Detailed case narratives were provided by each laboratory which fully detail all QC issues for both sampling events and explain any QC deviations; these are provided in Appendices A2, A3, B2, B3, D1, and D2.

Trace metals analyses for the influent, effluent, sludge, and receiving water testing were supported through the use of SRMs, which are quality control reference materials with known metals values that are obtained from the National Bureau of Standards, National Institute of Standards and Technology, or other certified standards. These SRMs are analyzed by the laboratories at the same time as the project samples in order to ensure laboratory accuracy. Results of the analyses of SRMs should fall within acceptable limits and can be expressed as percent recovery. Except for chromium, nickel, zinc, and lead in one of the seawater SRMs run in association with the receiving water program, all metals SRM results were within acceptance limits (Appendix D4). Results for chromium and lead for that SRM sample fell within acceptable ranges when blank-corrected. These recovery problems were not seen in the other SRM analysis performed for these metals, and data quality was not judged to be adversely

affected as other QC checks for these samples were found to be acceptable and no further corrective action was taken. In addition, SRMs were also analyzed for TSS and cyanide receiving water samples and found to be within acceptance recovery limits (Appendix D1).

Method blanks (or procedural blanks) were also analyzed for most analyses on the program. Method blanks consist of pure, organic- or metal-free reagent water that is run through the analysis process and used to verify that analyte concentrations are accurate and do not reflect contamination. With the exception of the ultra-trace level metals analyses that were conducted as part of the receiving water program and methylene chloride and 1,2-dichlorobenzene seen in the summer dry or summer wet analyses, all method blank results for the program showed no contamination during 2006. Chromium, copper, lead, and zinc were detected in either the pre-concentration, dissolved, or total blanks and all other metals were undetected above MDLs in the blanks, so no further action was taken other than flagging the data. A detailed case narrative for these samples provided by the laboratory which fully details all QC issues is provided in Appendix D4.

Although the method blanks for the June 2006 volatile organic analyses (EPA 624) did not indicate any contamination, laboratory contamination may have occurred as methylene chloride was noted in both the trip and field blanks that consisted of HPLC grade DI water. The August 2006 summer wet influent and effluent sampling also indicated methylene chloride contamination as it was seen in the method, field, and trip blank analyses. The method blank analyses performed with the TSS and cyanide analyses showed no results above method detection limits. In addition to the typical method blanks, buffered dilution water was used as a blank for fecal coliform and enterococci bacteriological analyses. All blanks run for fecal coliform and enterococci showed no growth. In accordance with the laboratories QA/QC policy, all sample results less than twenty times the level found in the method blank were flagged as estimated concentrations.

## **5.0 DISCUSSION**

### **5.1 INFLUENT, EFFLUENT, AND SLUDGE MONITORING**

The NPDES permit for the Asplund WPCF requires compliance with applicable State water quality standards as promulgated in Chapter 70 of the Alaska Administrative Code entitled "Water Quality Standards" (18 AAC 70; ADEC, 1999). This chapter requires that criteria outlined in "EPA Quality Criteria for Water" (also known as "The Red Book"; EPA, 1976), the revised quality criteria for water (EPA 1986b), and other applicable criteria as referenced in the AWQS be met in applicable receiving waters at every point outside of the ZID boundary. Also, as noted in Section 1.1.1, the State of Alaska water quality regulations include SSWQC for the Point Woronzof area of Cook Inlet for turbidity and the dissolved fraction of arsenic, cadmium, hexavalent chromium, copper, lead, mercury, nickel, selenium, silver, and zinc. Since the issuance of the current Permit, EPA has approved ADEC's proposed use of dissolved metals for all of the State's marine water quality criteria, approved all of ADEC's proposed SSWQC for Upper Cook Inlet, and removed Alaska from the National Toxics Rule list (EPA 2006; Sept. 15, 2006 letter to ADEC). Except for cadmium, where the dissolved standard changed from 9.3 to 8.8 µg/L, all other dissolved metals criteria are the same as those listed in the SSWQC. Even though EPA has approved the use of dissolved metals criteria for Alaska's marine water quality criteria, the current SSWQC will most likely remain in affect for the Point Woronzof area for permit renewal. Therefore, we have used both the SSWQC and the more restrictive criteria for dissolved cadmium to evaluate the data in this report. Finally, the permit itself includes some effluent limitations that must be met. The following sections discuss the parameters of concern in regards to the requirements of the NPDES permit or the AWQS as well as historical data from the WPCF, data from other publicly-owned treatment works (POTWs), or other EPA data.

#### **5.1.1 Influent and Effluent Monitoring**

Table 21 lists permit effluent limitations and water quality criteria that are applicable to the current NPDES permit; it includes each of the parameters required to be monitored by the permit. Most of the values shown are the chronic toxicity criteria for salt water aquatic life. Chronic toxicity criteria concentrations are lower than acute toxicity criteria concentrations; therefore, the more stringent of the two values were used here for comparison. The MAEC for each constituent was calculated from the outfall design dilution factor of 142:1 (for conservative substances) or 180:1 (for non-conservative substances), the water quality criteria, and the natural background concentrations as determined at the control site near Point MacKenzie. It was assumed that the final effluent would be diluted by a minimum factor of 142 by the time it reached the boundary of the ZID. For most metals, the MAECs were calculated from the SSWQC for dissolved metals contained in the AWQS for the Point Woronzof area.

To determine compliance with State water quality standards, Table 21 can be compared with effluent values found in Table 8 through Table 11 as well as those in Table 16 and Table 17. The AWWU 2006 maximum effluent concentrations shown in Table 21 were the maximum encountered during the calendar year either during AWWU's in-plant monitoring, the toxic pollutant and pesticide monitoring events, pretreatment monitoring, or the supplemental effluent monitoring that was performed as part of the receiving water sampling. For metals, both total and dissolved concentrations in the effluent were compared against their MAEC, since it is assumed that all of the metals contained in the effluent are potentially bioavailable upon entering

**Table 21. NPDES Requirements, State of Alaska Water Quality Standards, and AWWU 2006 Maximum Concentrations for Effluent Comparisons.** Non-compliant values are shown in **bold** type.

Parameter	Receiving Water Quality Standard <sup>a</sup>		Maximum Allowable Effluent Concentration <sup>b</sup> (MAEC)	AWWU 2006 Maximum Effluent Concentration <sup>c</sup>
Antimony (µg/L)	146	Human health, not listed for saltwater aquatic life	20,607	0.68 <sup>e</sup>
Arsenic (µg/L)	36	Chronic toxicity, measured as dissolved	4,882	3.0 <sup>e</sup>
Beryllium (µg/L)	11	For the protection of aquatic life in soft fresh water	1,513	ND(0.50) <sup>d,f</sup>
Cadmium (µg/L)	9.3 (8.8) <sup>i</sup>	Chronic toxicity, measured as dissolved	1,322 (1,250)	0.37 <sup>e</sup>
Chromium (VI) <sup>i</sup> (µg/L)	50	Chronic toxicity, measured as dissolved	7,038	6.6 <sup>e</sup>
Copper (µg/L)	3.1	Chronic toxicity, measured as dissolved	317	77 <sup>e</sup>
Lead (µg/L)	8.1	Chronic toxicity, measured as dissolved	1,140	4.1 <sup>e</sup>
Mercury (µg/L)	0.025	Chronic toxicity, measured as dissolved	2.73	0.13 <sup>d,e,f</sup>
Nickel (µg/L)	8.2	Chronic toxicity, measured as dissolved	978	5.7 <sup>e</sup>
Selenium (µg/L)	71	Chronic toxicity, measured as dissolved	10,136	9.6 <sup>d,f</sup>
Silver (µg/L)	1.9	Acute toxicity, measured as dissolved	257	3.1 <sup>d,e,f</sup>
Thallium (µg/L)	2,130	Acute toxicity to saltwater aquatic life	306,567	ND(0.50) <sup>d,f</sup>
Zinc (µg/L)	81	Chronic toxicity, measured as dissolved	11,249	110 <sup>e</sup>



**Table 21. NPDES Requirements, State of Alaska Water Quality Standards, and AWWU 2006 Maximum Concentrations for Effluent Comparisons. (continued)**  
Non-compliant values are shown in **bold** type.

Parameter	Receiving Water Quality Standard <sup>a</sup>		Maximum Allowable Effluent Concentration <sup>b</sup> (MAEC)	AWWU 2006 Maximum Effluent Concentration <sup>c</sup>
Cyanide (µg/L)	1	For marine aquatic life	181	5 <sup>d,e,f</sup>
Total Aqueous Hydrocarbons (TAqH) (µg/L)	15	Growth and propagation of fish, shellfish, aquatic life, and wildlife including seabirds, waterfowl, and furbearers <sup>g</sup>	2,715	39.52 <sup>f</sup>
Total Aromatic Hydrocarbons as BETX (µg/L)	10	Same as above <sup>g</sup>	1,810	32.23 <sup>f</sup>
pH (pH units)		<i>h</i>	6.5 - 8.5	6.5-8.1 <sup>j</sup>
Total Residual Chlorine (TRC) (mg/L)		<i>h</i>	Daily Max. 1.2	Daily Max 1.09 <sup>j</sup>
BOD <sub>5</sub> (mg/L)	<i>h</i>		Monthly Avg. 240	Monthly Avg.165 <sup>j</sup>
			Weekly Avg. 250	Weekly Avg. 188 <sup>j</sup>
			Daily Max. 300	Daily Max. 203 <sup>j</sup>
			Monthly Removal Rate ≥30 %	<b>(Monthly Avg. Rate 28-39%<sup>j</sup>)</b>
				Annual Removal Rate (34% in 06) <sup>j</sup>

**Table 21. NPDES Requirements, State of Alaska Water Quality Standards, and AWWU 2006 Maximum Concentrations for Effluent Comparisons. (continued)**  
Non-compliant values are shown in **bold** type.

Parameter	Receiving Water Quality Standard <sup>a</sup>	Maximum Allowable Effluent Concentration <sup>b</sup> (MAEC)	AWWU 2006 Maximum Effluent Concentration <sup>c</sup>
Total Suspended Solids (TSS) (mg/L)	<i>h</i>	Monthly Avg. 170 Weekly Avg. 180 Daily Max. 190 Monthly Removal Rate $\geq 30\%$	Monthly Avg. 59 <sup>j</sup> Weekly Avg. 74 <sup>j</sup> Daily Max. 90 <sup>j</sup> Monthly Avg. Rate 73-80% <sup>j</sup> , Annual Removal Rate 76% <sup>j</sup>
Total Ammonia (mg/L)	9.8 <sup>k</sup>	1,774	Monthly Max. 21.5 <sup>j</sup>
Fecal Coliform (FC MPN/100 mL)	<i>h</i>	Monthly geometric mean of at least five samples shall not exceed 850.  Not more than 10% of samples shall exceed 2600.	Monthly mean maximum was 229 <sup>j</sup>  <b>More than 10% of the samples collected in July and October 2006 exceeded 2600.<sup>j</sup></b>

*a* Alaska Administrative Code, 1999. Water Quality Standards, Chapter 70 (18 AAC 70)

*b* For conservative substances, effluent water quality criteria were determined by assuming a dilution of 142:1 at the ZID boundary, where: MAEC = 142 \* (Criteria - Natural Background Concentration) + Criteria; pollutant concentrations in the effluent should not exceed these values. For non-conservative substances, a dilution of 180:1 was utilized in the MAEC calculation.

*c* For metals, the maximum effluent concentration was determined from both total and dissolved concentrations.

*d* Values from June 2006 or August 2006 toxic pollutant and pesticide samplings.

*e* Values from AWWU's pretreatment program.

*f* Values from effluent tested during receiving water sampling event.

*g* Alaska Administrative Code, 1999. Water Quality Standards, Chapter 70 (18 AAC 70).

*h* MAECs are not based on water quality criteria but instead are specified in MOA's 2000 NPDES permit.

*i* All samples tested as total chromium.

*j* Values from AWWU's in-plant monitoring.

*k* Ammonia receiving water criteria based on pH of 8.0, temperature of 15.0°C, and salinity of 20‰.

*l* Cadmium standard based on new revised EPA level that was approved for State of Alaska.

*J* Estimated concentration.

MGD Million gallons/day.

the receiving water. All effluent concentrations were found to be much lower than the MAECs from the permit or computed from the water quality standards provided for in the AWQS. In addition, the permit limitations for all but two parameters (fecal coliform and BOD<sub>5</sub>) were met for the 2006 program year. Individual parameters are discussed more fully below. When the MAECs in Table 21 were compared to AWWU's self-monitoring effluent data, the toxic pollutant and pesticides sampling events (June 2006 and August 2006), the pretreatment monitoring data, and the effluent data from the receiving water quality sampling event, no metals or cyanide values exceeded their MAECs. The highest concentrations of either total or dissolved metals seen in 2006 were all well below their respective MAECs. The one metal that most closely approached its MAEC at any time was copper, and this was considerably below its MAEC. The maximum concentration of total copper was 77 µg/L compared to a MAEC of 317 µg/L. The highest dissolved copper concentration that was seen was 26 µg/L.

Those metals without SSWQC, while analyzed as both total and dissolved metals as called for by the permit, are compared to total recoverable metal MAECs as provided by EPA criteria and as called for by the AWQS. Total metals concentrations for antimony, beryllium, and thallium were generally low, often below detection limits, and all well below their MAECs. As in past years, total recoverable metals detected in the influent and final effluent were compared with data from an EPA study of 40 Publicly Owned Treatment Works (POTWs) in Table 22 (EPA, 1982a). Without exception, metals and cyanide values were lower than or within the range of those detected in other POTWs from across the nation, even though the Asplund WPCF provides only primary treatment as compared to secondary treatment provided at the other plants.

Historic influent and effluent total recoverable metals and cyanide concentrations collected as part of AWWU's self-monitoring program are presented in Table 23 and Table 24. It should be noted that under the previous permit, the reporting year was November - October, which differs from the current permit's reporting period of the calendar year. In addition, prior to 2000 when the permit requirements changed, dissolved metals had only been analyzed in a single sample of effluent collected each year during the receiving water sampling. Beginning in August 2000, dissolved metals from the effluent have been analyzed in both the summer wet and summer dry sampling events. Concentrations are low and fairly consistent over time. Concentrations of total recoverable metals and cyanide concentrations seen in the influent and effluent during 2006 generally fell within the range of concentrations seen during prior years. Concentrations of dissolved metals were generally found to fall within range of concentrations seen since August 2000 when this type of analysis was initiated.

During previous years, total copper levels would sometimes exceed the previous permit's MAEC of 100 µg/L. While this permit limit is no longer in effect, it is interesting to note that the maximum total copper concentration encountered in the effluent during the year 2006 (from the pretreatment monitoring) was considerably lower at 77 µg/L. The reasons for the elevated copper concentrations in previous years were investigated and reported to the Municipality by CH2M Hill and the AWWU laboratory. The conclusion of the copper investigation was that most of the copper in the influent is from the leaching of copper from residential plumbing rather than industrial discharge (CH2M Hill, 1987; CH2M Hill et al., 1988). Neither enforcement of the sewer ordinance (AMC 26.50) nor the industrial pretreatment program was expected to significantly reduce the amounts of copper received at the Asplund WPCF. The mass of copper in the plant influent and effluent remained fairly constant from 1986 through 1991. From 1991 to 1992, the in-plant copper loading dropped by approximately 25 %. The exact cause of this

**Table 22. Comparison Between Influent/Effluent Analysis Results for Anchorage and 40 POTWs.<sup>a</sup>**

Parameter	Anchorage Values				40 POTW Study Values				
	2006 Concentration <sup>b,c</sup> (µg/L)				Frequency of Detection (%)		Range Detected (µg/L)		Influent Median
	Summer-Dry		Summer-Wet		Influent	Secondary Effluent	Influent	Secondary Effluent	(µg/L)
	INF	EFF	INF	EFF					
VOLATILES <sup>d</sup>									
Benzene	0.50 J	ND (5.0)	0.40 J	0.59 J	61	23	1-1560	1-72	2
Bromodichloromethane	ND (5.0)	ND (5.0)	ND (5.0)	0.34 J	3	16	1-3	1-6	NA
Chloroform	2.9 J	3.6 J	2.5 J	3.8 J	91	82	1-430	1-87	7
Chloromethane	ND (10)	ND (10)	ND (10)	1.1 J	NA	NA	NA	NA	NA
1,4 Dichlorobenzene	1.0 J	1.0 J	1.5 J	1.1 J	17	3	2-200	3-9	NA
Ethylbenzene	1.5 J	ND (5.0)	0.66 J	0.62 J	80	24	1-730	1-49	8
Methylene chloride	3.5 J	4.5 J	3.8 J,B	3.3 J,B	92	86	1-49000	1-62000	38
Tetrachloroethene	4.2 J	4.0 J	2.1 J	1.4 J	95	79	1-5700	1-1200	23
Toluene	12	8.7	7.8	8.7	96	53	1-13000	1-1100	27
Xylene (Total)	8.3 J	6.7 J	2.8 J	3.1 J	NA	NA	NA	NA	NA
SEMI-VOLATILES <sup>d</sup>									
Bis(2-ethylhexyl)phthalate	21	18	14	10	92	84	2-670	1-370	27
Butyl benzyl phthalate	ND (20)	ND (20)	5.7 J	ND (20)	57	11	2-560	1-34	3
Diethyl phthalate	7.9 J	7.7 J	9.0 J	7.9 J	53	13	1-42	1-7	3
Phenol	27	18	ND (10)	13	79	29	1-1400	1-89	7
TOTAL METALS & OTHER COMPONENTS									
Antimony	0.96	0.65	0.81	0.58/0.60	14	13	1-192	1-69	NA
Arsenic	2.6	2.4	2.8	2.6/2.8	15	12	2-80	1-72	NA
Beryllium	ND (0.50)	ND (0.50)	ND (0.50)	ND /ND	3	1	1-4	1-12	NA
Cadmium	0.38	0.27	0.37	0.24/0.25	56	28	1-1800	2-82	3
Chromium	3.9	2.2	4.9	2.8/2.7	95	85	8-2380	2-759	105
Copper	81	51	81	49/48	100	91	7-2300	3-255	132
Lead	4.8	2.7	7.1	2.9/2.9	62	21	16-2540	20-217	53
Mercury	0.11	0.13	0.17	0.10	70	31	0.2-4	0.2-1.2	0.517
Nickel	4.1	2.8	7.7	4.2/4.3	79	75	5-5970	7-679	54
Selenium	ND (1.0)	1.4	1.2	1.4/ND	9	10	1-10	1-150	NA
Silver	4.1	3.1	4.3	2.3/2.4	71	25	2-320	1-30	8
Thallium	ND (0.50)	ND (0.50)	ND (0.50)	ND/ND	3	2	1-19	1-2	NA
Zinc	180	100	200	97/96	100	94	22-9250	18-3150	273
Cyanide	ND (<1)	5	ND (<1)	ND (<1)	100	97	3-7580	2-2140	249

<sup>a</sup> Source: EPA, 1982. *Fate of Priority Pollutants in POTWs*. Final Report, Volume I, Effluent Guidelines Division, WH-552, EPA 440/1-82/303

<sup>b</sup> Data from NPDES 2006 toxic pollutant and pesticide monitoring

<sup>c</sup> Duplicate analyses provided for some analyses (value/lab duplicate value)

<sup>d</sup> Only analytes detected in either the influent or effluent are included

B Also detected in associated method blank

J Estimated value

NA Not available

ND Not detected

NT Not tested

**Table 23. Comparison of Toxic Pollutants and Pesticides in Anchorage's Final Effluent to the Previous Five Years.** Values in brackets are from EPA Method 602 where available.

Pollutant	2001		2002		2003	
	Dry <sup>b</sup>	Wet <sup>b</sup>	Dry <sup>b</sup>	Wet <sup>b</sup>	Dry <sup>b</sup>	Wet <sup>b,c</sup>
	6/19-20	9/4-5	7/22-23	8/26-27	6/25-26	8/12-13
<b>ORGANICS (µg/L)</b>						
Benzene	1.62[ND/ND/ND]	1.99[ND/ND]	ND[0.58/0.59]	ND[ND/ND]	ND[ND/ND]	ND[ND/ND]
* Benzoic Acid	ND	109	NT	NT	NT	NT
Bis-(2-ethylhexyl) phthalate	22.9	272	11	8.9 J /21	18 B	13
Bromomethane	ND	ND	ND	ND	7.0 J	ND
Butyl benzyl phthalate	ND	ND	3.3 J	ND/ND	3.0 J	ND
Chloroform	2.98	3.60	4.3 J	4.8 J	3.8 J	3.2 J
Chloromethane	ND	ND	ND	ND	ND	ND
* 1,2-Dichlorobenzene	ND/ND[6.2/5.6/6.0]	ND/ND[ND/ND]	ND	ND	ND[ND/ND]	ND[ND/ND]
* 1,3-Dichlorobenzene	ND/ND[4.5/4.4/4.6]	1.27/ND[ND/ND]	ND	ND	ND[ND/ND]	ND[ND/ND]
* 1,4-Dichlorobenzene	ND/ND[1.1/1.1/1.1]	ND/ND[1.7/1.7]	ND	ND	ND[ND/ND]	ND[1.2/1.2]
Diethyl phthalate	ND	12.6	8.9 J	6.0 J/7.5 J	7.3 J	11
Di-n-butyl phthalate	ND	ND	2.9 J	ND/ND	1.6 J	ND
Ethylbenzene	ND[ND/ND/ND]	2.40[ND/ND]	ND [0.62/0.61]	ND[0.80/0.81]	ND[1.8/1.1]	ND[1.1/1.3]
Methylene Chloride	ND	ND	5.0 B	0.94 J	4.1 J	2.9J
Phenol	ND	ND	24	11/ND	18	23
Tetrachloroethene	2.16	2.34	ND	0.95 J	ND	ND
Toluene	9.37[4.2/4.0/4.2]	8.95[8.0/7.7]	9.1[11/10]	8.2[6.2/6.4]	7.4[5.8/6.4]	5.3[9.0/9.6]
* Total Xylenes	2.42[ND/ND/ND]	12.51[ND/ND]	NT[3.0/2.8]	NT[5.7/5.8]	5.1 J[6.9/8.3]	ND[14/15]
Total Hydrocarbons as Oil and Grease <sup>a</sup>	21200	20400	21800	23500	24000	20100
Total Aromatic Hydrocarbons as BETX <sup>d</sup>	13.6[5.7/5.5/5.7]	25.8[11.0/10.7]	NT[15.2/14]	18.2[13.2/13.5]	22.5[15.5/16.8]	25.3[24.6/26.4]

**Table 23. Comparison of Toxic Pollutants and Pesticides in Anchorage's Final Effluent to the Previous Five Years. (continued)**

Pollutant	2003		2004		2006	
	Dry <sup>b</sup>	Wet <sup>b</sup>	Dry	Wet	Dry	Wet
	6/23-24	8/23-24	5/23-24	8/1-2	6/27-28	8/15-16
<b>ORGANICS (µg/L)</b>						
Benzene	ND[0.24 J]	ND	ND [ND]	3.3 J	ND [0.43J]	0.59 J
* Benzoic Acid	NT	NT	NT	NT	NT	NT
Bis-(2-ethylhexyl) phthalate	16	15	15	14 B	18	10
Bromomethane	ND	ND	ND	ND	ND	ND
Butyl benzyl phthalate	ND	4.2 J	7.4 J	2.7 J	ND	ND
Chloroform	3.2 J	3.6 J	2.6 J	4.1 J	3.6 J	3.8 J
Chloromethane	ND	ND	ND	1.4 J	ND	1.1 J
* 1,2-Dichlorobenzene	ND	ND	ND	ND	ND	ND
* 1,3-Dichlorobenzene	ND	ND	ND	ND	ND	ND
* 1,4-Dichlorobenzene	ND	ND	ND	ND	1.0 J	1.1 J
Diethyl phthalate	8.5 J	7.4 J	8.5 J	10	7.7 J	7.9 J
Di-n-butyl phthalate	1.7 J	ND	ND	ND	ND	ND
Ethylbenzene	ND[0.37J,COL]	ND	ND [ND]	ND	ND [3.8]	0.62 J
Methylene Chloride	4.4 J	4.7 J,B	2.6 J,B	5.0 B	4.5 J	3.3 J,B
Phenol	19	19	19	21	18	13
Tetrachloroethene	ND	ND	ND	ND	4.0 J	1.4 J
Toluene	5.9[6.4]	7.2	4.0 J [5.6]	10	8.7 [11]	8.7
* Total Xylenes	ND[1.3COL]	ND	1.5 J [0.93]	2.4 J	6.7 J [17]	3.1 J
Total Hydrocarbons as Oil and Grease <sup>a</sup>	26300	25400	21400	17600	19900	19400
Total Aromatic Hydrocarbons as BETX <sup>d</sup>	25.9[8.31]	27.2	15.5 [7.53]	20.7	25.4	13.0

**Table 23. Comparison of Toxic Pollutants and Pesticides in Anchorage's Final Effluent to the Previous Five Years. (continued)**

Pollutant	2001		2002		2003	
	Dry <sup>b</sup>	Wet <sup>b</sup>	Dry <sup>b</sup>	Wet <sup>b</sup>	Dry	Wet <sup>b</sup>
	6/19-20	9/4-5	7/22-23	8/26-27	6/25-26	8/12-13
<b>TOTAL METALS (µg/L)</b>						
Antimony	ND	ND/ND	ND	ND/ND	ND	ND/ND
Arsenic	ND	ND	3	ND	3	5
Beryllium	ND	ND	ND	ND	ND	0.07
Cadmium	0.3	0.3	ND	0.4	ND	0.7
Chromium	4.1	3.2	1.5	3.0	7	2
Copper	56	39	60.4	61	60	49
Lead	6	6	6	9.0	7	2
Mercury	0.2	0.1	ND	ND	0.13	0.1
Nickel	3	4	4	3	1	5
Selenium	ND	ND/ND	ND	ND/ND	ND	ND/ND
Silver	10.7	6.0	6.4	6.0	3.3	2.8
Thallium	ND	ND/ND	ND	ND/ND	ND	ND/ND
Zinc	70	60	139	80	70	69
<b>DISSOLVED METALS (µg/L)</b>						
Antimony	ND	ND/ND	ND	ND/ND	ND	ND/ND
Arsenic	ND	7	ND	3	ND	4
Beryllium	ND	ND	ND	0.46	ND	ND
Cadmium	ND	0.3	0.5	0.2	ND	0.9
Chromium	0.6	ND	ND	1.7	ND	1
Copper	28	28	34.9	39	27	39
Lead	3	3	5	1	7	ND
Mercury	ND	ND	ND	ND	0.05	ND
Nickel	4	4	6	3.0	3	3
Selenium	ND	ND/ND	ND	ND/ND	ND	ND/ND
Silver	1.5	0.9	0.5	1.1	0.6	ND
Thallium	ND	ND/ND	ND	ND/ND	ND	ND/ND
Zinc	20	50	87	40	30	69
<b>PESTICIDES (µg/L)</b>						
Aldrin	ND/ND/ND	ND	ND	0.081	ND	ND
alpha-BHC	ND/ND/ND	ND	ND	0.10	ND	ND
beta-BHC	ND/ND/ND	ND	ND	ND	ND	ND
delta-BHC	ND/ND/ND	ND	ND	0.86	ND	ND
Dieldrin	ND/ND/ND	ND	ND	ND	ND	ND
Endosulfan II	ND/ND/ND	ND	ND	ND	ND	ND
Endrin ketone	ND/ND/ND	ND	ND	ND	ND	ND
Heptachlor	ND/ND/ND	ND	ND	ND	ND	ND
4,4'-DDE	0.04/ND/ND	ND	ND	ND	ND	ND
Malathion	ND/ND/ND	ND	ND	ND	0.31	ND
<b>OTHER</b>						
Cyanide (µg/L)	ND	ND	ND	ND	ND	ND
Asbestos (million fibers/L)	20	13	20	6.6	ND	ND

**Table 23. Comparison of Toxic Pollutants and Pesticides in Anchorage's Final Effluent to the Previous Five Years. (continued)**

Pollutant	2004		2005		2006	
	Dry	Wet <sup>b</sup>	Dry	Wet <sup>b</sup>	Dry	Wet <sup>b</sup>
	6/23-24	8/23-24	5/23-24	8/1-2	6/27-28	8/15-16
<b>TOTAL METALS (µg/L)</b>						
Antimony	ND	ND/ND	0.65	ND/ND	0.65	0.58/0.60
Arsenic	ND	ND	3	2	2.4	2.6/2.8
Beryllium	0.2	0.1	0.1	ND	ND	ND/ND
Cadmium	ND	ND	0.3	ND	0.27	0.24/0.25
Chromium	4	ND	5	3	2.2	2.8/2.7
Copper	63	65	52	54	51	49/48
Lead	12	4	6	2	2.7	2.9/2.9
Mercury	0.11	0.70	0.10	0.11	0.13	0.10
Nickel	5	ND	4	4	2.8	4.2/4.3
Selenium	ND	ND/ND	0.47	ND/ND	1.4	1.4/ND
Silver	3.9	ND	1.7	1.4	3.1	2.3/2.4
Thallium	ND	ND/ND	ND	ND/ND	ND	ND/ND
Zinc	140	76	90	90	100	97/96
<b>DISSOLVED METALS (µg/L)</b>						
Antimony	ND	ND/ND	0.45	ND/ND	ND	ND
Arsenic	ND	ND	2	2	1.2	1.9
Beryllium	ND	0.1	0.1	ND	ND	ND
Cadmium	0.6	ND	ND	ND	ND	ND
Chromium	ND	ND	4	2	0.79	0.55
Copper	27	49	37	42	1.4	26
Lead	4	8	6	2	0.064	0.42
Mercury	ND	ND	ND	ND	0.035	0.027
Nickel	6	ND	ND	ND	3.7	2.9
Selenium	ND	ND/ND	ND	ND/ND	9.6	1.1
Silver	ND	0.6	ND	0.9	ND	ND
Thallium	ND	ND/ND	ND	ND/ND	ND	ND
Zinc	40	12	40	40	3.3	35
<b>PESTICIDES (µg/L)</b>						
Aldrin	ND	ND	ND	ND	ND	ND
alpha-BHC	ND	ND	ND	ND	ND	0.023 J
beta-BHC	ND	ND	ND	0.037 J	ND	ND
delta-BHC	ND	ND	ND	ND	ND	ND
Dieldrin	ND	ND	ND	ND	0.010 J,COL	0.021 J
Endosulfan II	ND	ND	0.075 J	ND	ND	0.042 J
Endrin ketone	ND	ND	ND	ND	0.012 J,COL	ND
Heptachlor	ND	ND	0.17 J	0.99	ND	0.54
4,4'-DDE	ND	ND	ND	ND	0.0080 J,COL	ND
Malathion	ND	ND	0.49 J, CHI	ND	ND	ND
<b>OTHER</b>						
Cyanide (µg/L)	ND	ND	ND	ND	5	ND
Asbestos (million fibers/L)	ND	ND	ND	ND	ND	ND

*a* EPA method 1664 HEM (2000-2005) *b* Duplicate effluent collected (field duplicate) or analyzed (lab duplicate) shown as value/duplicate value *c* Values from EPA Method 624 are the result of averaging eight samples with zero used for ND (2002 Wet)  
*d* BETX calculated from EPA 624 for year 2000 do not include xylenes as they were not tested \* Non-priority pollutants  
J Estimated value CHI More than 40% RPD between primary and confirmation results. The higher of the two results is reported.  
COL More than 40% RPD between primary and confirmation results. The lower of the two results is reported.  
B Compound also detected in method blank ND Not detected NT Not tested



**Table 24. Historical Discharge Monitoring Data (1986 - Present) for Influent and Effluent Total Metals and Cyanide.** Concentrations are in µg/L. Values represent a range of minimum (Min) and maximum (Max) results for 1986-2000 as available. Results for 2001-2006 are from pretreatment monitoring (Avg of six results from both the wet and dry sampling events).

Year	Average Flow (mgd)	Arsenic		Beryllium		Cadmium		Copper		Lead		Mercury		Nickel		Silver		Zinc		Chromium		Cyanide	
		Inf.	Eff.	Inf.	Eff.	Inf.	Eff.	Inf.	Eff.	Inf.	Eff.	Inf.	Eff.	Inf.	Eff.	Inf.	Eff.	Inf.	Eff.	Inf.	Eff.	Inf.	Eff.
1986-2000 Min	23	<1	<1	<0.1	<0.1	<0.5	<0.5	36	10	<1	<1	<0.1	<0.1	<1	<1	2.1	1	54	38	<1	<1	<0.4	1
1986-2000Max	40	26	16	0.4	0.2	20	30	280	150	149	50	3.0	1.5	77	60	30.4	98	260	240	112	120	85	50
2001 Avg	28	4	3	0.04	0.03	0.6	0.4	84	48	14	8	0.3	0.1	7	4	11.4	7.2	140	70	5	3.5	<10	<10
2001 Min	26	<3	3	<0.03	<0.03	0.4	0.2	82	39	8	4	0.2	<0.1	4	3	10.2	5.5	130	60	3.4	3.0	<10	<10
2001 Max	30	5	5	0.06	<0.03	0.7	1.0	88	56	27	19	0.4	0.2	10	6	12.9	10.7	150	80	6.2	4.1	<10	<10
2002 Avg	29	4	3	0.12	.082	0.5	0.4	92	63	10	6	0.4	0.1	6	4	9	6	165	158	4	3	10	10
2002 Min	27	<3	<3	0.06	<0.04	0.4	0.4	77	59	7	5	0.1	<0.1	5	3	7	4	110	80	3	1.5	<10	<10
2002 Max	34	4	3	0.22	0.21	0.6	<0.5	108	68	12	9	1.6	0.1	9	5	13	11	239	407	6.7	4.1	<10	<10
2003 Avg	28	3	3	0.09	0.09	0.8	0.6	88	57	11	5	0.3	0.1	4	5	5.6	3.3	133	79	5	3	<10	<10
2003 Min	26	1	1	0.07	0.07	0.5	<0.5	79	49	5	2	0.2	0.1	2	<1	4.3	2.7	100	69	2	2	<10	<10
2003 Max	31	5	5	0.11	0.11	1.0	0.7	110	65	19	7	0.4	0.2	6	13	6.7	3.9	151	100	9	7	<10	<10
2004 Avg	29	3	2	0.2	0.2	0.4	<0.3	83	58	10	6	0.4	0.2	7	5	5.9	3.2	169	120	5	4	<10	<10
2004 Min	26	<2	<2	0.1	0.1	<0.3	<0.3	71	46	6	4	0.1	0.1	<6.2	<6.2	<1.5	<1.5	140	76	<6.2	<6.2	<10	<10
2004 Max	34	4	2	0.2	0.3	<6.2	<6.2	99	68	12	12	0.9	0.7	8	<6.2	7.2	3.9	192	150	<6.2	<6.2	<10	10
2005 Avg	28	3	3	0.1	0.1	0.4	0.3	90	53	7	4	0.3	0.1	9	5	3.3	1.7	155	92	6	4	<0.9	<0.9
2005 Min	24	2	<2	<0.1	<0.1	<0.3	<0.3	78	47	4	2	0.1	0.1	6	4	2.8	1.3	140	80	4	1	<0.9	<0.9
2005 Max	30	4	4	0.1	0.1	0.4	0.3	116	57	10	6	0.5	0.1	17	8	4.3	2.2	180	110	7	7	<0.9	<0.9
2006 Avg	28	3	3	0.5	0.5	0.4	0.3	84	57	5	3	0.1	0.1	7	4	4	3	190	99	7	3	1.0	1.7
2006 Min	26	3	2	<0.5	<0.5	0.3	0.2	75	48	2	2	0.1	0.1	4	3	2	2	180	94	4	2	<1.0	<1.0
2006 Max	32	3	3	<0.5	<0.5	0.5	0.4	93	77	8	4	0.2	0.1	11	6	6	3	200	110	15	7	<1.0	5

Inf. Influent  
Eff. Effluent  
mgd million gallons per day

decrease is unknown; however, an increase in pH (to approximately 8.0) at the Water Treatment Facilities (Ship Creek and Eklutna) during the spring of 1991 caused a decrease in copper concentrations taken from "first draw" residential water sources in Anchorage. This increase in alkalinity was implemented to reduce corrosion in the drinking water distribution system. It would follow that these decreased values in drinking water would also affect the influent concentrations.

Total arsenic concentrations in the final effluent had remained fairly steady over the last five years, and 2006 values remained well within the range of those values seen before. The maximum total arsenic concentration in final effluent seen during 2006 was 3.0 µg/L, compared to an MAEC of 4,882 µg/L (Table 21). Arsenic values are not a serious concern for this permit in terms of effluent concentrations, since the concentration in the final effluent is so much lower than the MAEC.

During June 2006, 5 µg/L of cyanide was reported in the effluent during the first day of pretreatment monitoring efforts, well below the MAEC of 181 µg/L. The remaining concentrations of cyanide in the effluent were <1 µg/L during the June 2006 and August 2006 samplings. Cyanide concentrations in the effluent collected during the receiving water sampling were reported as 0.39 µg/L (with a lower reporting limit of 0.10 µg/L). Cyanide had been a constituent of concern in past years because it approached or even exceeded the prior MAEC of 50 µg/L in some years. In 1986 it was observed that the effluent cyanide concentrations often exceeded the influent concentrations by an order of magnitude. This trend continued during subsequent years of sampling and was the subject of a special investigation conducted by the AWWU. The conclusion of this investigation was that the measured increase in cyanide between the influent and effluent was the result of the treatment plant's incinerator. Cyanide formed in the incinerator during sludge incineration is returned to the plant during the stack scrubbing process (CH2M Hill, 1987; CH2M Hill in association with Loren Leman, P.E., 1988). Subsequently, cyanide decreased and this was believed to be due to the change in the scrubbing water source from recirculated primary effluent to well water.

The most restrictive criteria of growth and propagation of fish, shellfish, other aquatic life, and wildlife was used for the hydrocarbon limits presented in Table 21. The MAECs for TAqH and total aromatic hydrocarbons as BETX were met again this year, with maximum levels in the effluent well below the state-specified limits. The parameter of TAqH was analyzed in effluent only during the receiving water quality sampling, and the TAqH concentration was 39.52 µg/L as compared to the MAEC of 2,715 µg/L. The maximum BETX value measured by the EPA 624 method of 25.4 µg/L was seen during the toxic pollutant and pesticide June 2006 sampling, and this value fell well below the MAEC of 1,810 µg/L.

The MAEC for total ammonia was met again this year, with effluent values exhibiting a maximum of 21.5 mg/L as compared to the MAEC of 1,774 mg/L. This MAEC is based on maximum criteria in saltwater of 9.8 mg/L based on a salinity of 20 psu, temperatures of 15°C, and a pH of 8.0 units (EPA, 1989).

In addition to the MAECs based on the State and Federal water quality criteria, a number of other effluent limitations are specified in the NPDES permit. These daily, weekly, and monthly limitations include pH, TRC, BOD<sub>5</sub>, TSS, and fecal coliform (Table 21). All of the parameters except fecal coliform and BOD<sub>5</sub> were found to be within their permit limitations for 2006.

For fecal coliform, the permit limitation of a monthly geometric mean (of at least five samples) that shall not exceed 850 FC MPN/100 mL was not exceeded this year, with the maximum monthly geometric mean of 229 FC MPN/100mL. Fecal coliform exceeded the monthly criteria "that not more than 10 % of the effluent samples shall exceed 2600 FC MPN/100 mL during any month" in July and October 2006.

The permit limitations for monthly and weekly averages and daily maximum were met for BOD<sub>5</sub> and TSS. Amendments to the Clean Water Act (40 CFR; Final Rule, 8/9/94), require at least 30 % average monthly removal for both of these parameters. BOD<sub>5</sub> and TSS met this requirement on an average annual basis; however on a average monthly basis, BOD<sub>5</sub> removals were slightly less at 29 % in March 2006. All other months met or exceeded the 30 % removal for both BOD<sub>5</sub> and TSS. Removal of BOD<sub>5</sub> averaged 34 % for the 2006 calendar year. Average removal rate of BOD<sub>5</sub> has decreased slightly over the last few years; this is suspected to be due to a greater percentage of soluble BOD<sub>5</sub> that cannot be removed by primary treatment processes. The monthly removal for TSS ranged from 73 to 80 % with an annual average of 76 %, about the same as reported for the last seven years and well above the average monthly criteria of 30 %.

Concentrations of other toxic pollutants and pesticides detected in the influent and final effluent were generally lower than or within the range of those detected in other POTWs from across the nation, even though the Asplund WPCF provides only primary treatment as compared to secondary treatment provided at the other plants (Table 22). Toxic pollutants and pesticides also generally fell within the historical range of values seen in past years; levels of toxic pollutants and pesticides detected in the Anchorage effluent this year and over the previous five years are shown in Table 23. These data indicated some variability over time, but a generally similar pattern overall. Levels were low and often below reporting limits. As in the past, the types and concentrations of measured organic compounds varied between the two sampling periods. This is probably the result of different point sources discharging into the Municipality's wastewater system at various times. Also, in some instances, large differences in pollutant concentrations occurred between the influent and effluent. Inconsistencies can be explained by looking at sampling methodology and plant operation in the case of point-source contaminants. If spikes of contaminants are occurring in the influent, these might be hit or missed during sampling. On the other hand, an effluent sample could contain the contaminant because of mixing in the clarifiers. Differences in concentrations in influent and effluent samples could also be due to lower suspended solids in the effluent samples. This can be seen in Table 9 and Table 10, where greater variability usually occurs in the influent concentrations as compared to the effluent.

Historic discharge monitoring data (1986 - 2006) for other parameters of concern measured in the influent and effluent are presented in Table 25. Most parameters have remained fairly steady over time. Dissolved oxygen levels increased from 1986 with a peak in 1992, and then generally decreased over the last ten years, including 2006. The cause of the changes in DO levels is unknown, however, previous changes in sampling location could account for this. Other constituents of potential concern such as TSS have remained fairly steady in the effluent; influent TSS levels had increased during 1991 due to improved sampling methodology but have remained fairly steady since that time, although the average and maximum value have increased slightly this year. The BOD<sub>5</sub> effluent average during 2006 (146 mg/L) was the same as that seen in both 2004 and 2005 and lower than that seen during the prior three years. However, BOD<sub>5</sub> levels in both the influent and effluent had generally shown a slight upward trend up until 2004 as a result of greater industrial contributors over the course of this long-term monitoring program.

**Table 25. Historical Discharge Monitoring Data (1986-Present) for Influent and Effluent Non-Metals.**

Year	Temperature (°C)		pH <sup>a</sup>		TRC (mg/L)		DO (mg/L)		BOD <sub>5</sub> (mg/L)		TSS (mg/L)		Fecal Coliform (FC/100 mL)		Ammonia (mg/L)	
	Influent	Effluent	Influent	Effluent	Influent	Effluent	Influent	Effluent	Influent	Effluent	Influent	Effluent	Influent	Effluent	Influent	Effluent
1986-2000 Min	9.0	9.0	6.4	6.4	NA	0.6	NA	2.1	98	69	117	39	NA	5	NA	15.0
1986-2000 Max	17.0	18.0	8.2	8.5	NA	1.0	NA	8.6	296	144	307	86	NA	726	NA	24.0
2001 Avg	13.3	13.7	NA	NA	NA	0.8	NA	6.2	243	142	243	46	NA	39	NA	21.0
2001 Min	11.1	11.5	6.9	6.7	NA	0.7	NA	5.2	225	125	223	37	NA	15	NA	13.8
2001 Max	16.0	16.3	7.8	7.6	NA	0.8	NA	6.8	284	156	267	61	NA	119	NA	29.3
2002 Avg	13.1	13.7	NA	NA	NA	0.4	NA	6.7	244	154	241	51	NA	179	NA	20.3
2002 Min	10.4	11.0	6.8	6.5	NA	0.3	NA	6.1	221	132	224	44	NA	32	NA	16.6
2002 Max	15.9	16.4	7.8	7.8	NA	0.5	NA	7.1	268	174	270	57	NA	462	NA	24.0
2003 Avg	13.6	14.0	NA	NA	NA	0.26	NA	4.9	252	161	235	48	NA	210	NA	21.8
2003 Min	11.4	11.2	6.9	6.6	NA	0.07	NA	3.8	228	155	215	44	NA	38	NA	20.3
2003 Max	16.1	17.1	7.8	8.1	NA	0.57	NA	6.3	269	170	252	52	NA	1141	NA	23.5
2004 Avg	12.9	13.6	NA	NA	NA	0.26	NA	3.9	226	148	229	49	NA	325	NA	20.9
2004 Min	10.6	11.2	6.7	6.6	NA	0.1	NA	2.1	205	133	204	45	NA	57	NA	17.2
2004 Max	16.2	17.2	8.0	8.1	NA	0.49	NA	5.2	259	168	280	51	NA	1213	NA	24.2
2005 Avg	12.7	13.2	7.6	7.3	NA	0.30	NA	4.6	205	148	235	54	NA	175	NA	20.0
2005 Min	10.7	11.1	7.4	7.2	NA	0.17	NA	3.1	194	131	216	45	NA	19	NA	18.5
2005 Max	15.6	16.1	7.9	7.5	NA	0.55	NA	6.2	284	174	273	58	NA	484	NA	22.0
2006 Avg	12.0	12.3	7.6	7.3	NA	0.34	NA	4.0	220	146	229	54	NA	44	NA	19.4
2006 Min	9.8	10.0	6.7	6.5	NA	0.18	NA	2.6	199	132	196	50	NA	4	NA	17.0
2006 Max	14.8	15.1	7.8	8.1	NA	0.56	NA	5.3	237	165	268	59	NA	229	NA	21.5

<sup>a</sup> Values represent yearly pH minimum and maximum

NA Not applicable

NT Not tested

The yearly average effluent fecal coliform bacteria concentration, reported at 44 MPN/100 mL for 2006, was considerably lower than the last three years. Elevated levels seen in 2004 were the highest yearly average seen on the program to date and were most likely the result of a program to optimize chlorine usage as described below. Lower fecal coliform values for 2006 showing a downward trend are more in line with prior data, indicating that the disinfection efficacy at the WPCF is improving.

As described in earlier reports, a project to improve the efficiency of the Asplund WPCF effluent disinfection system was implemented during 2001-2002. The existing chlorine injection process was improved by installation of rapid mixing equipment (the “Water Champ”, installed in November 2001) to mix chlorine gas directly with the effluent. Oxidation Reduction Potential (ORP) technology using a *Strantrol 890 Controller* was installed in December 2001 to control the chlorine dosage rate by adjusting it in response to both flow and oxidation reduction potential of the wastewater. Prior to this improvement, it was never possible to determine an exact correlation between TRC and coliform kill. Dosage control by the ORP has resulted in adequate coliform kills with far lower residuals and has substantially reduced the annual chlorine usage, but optimizing the disinfection process continues to be an on-going process.

The average TRC had dropped from 0.8 mg/L in 2001 to 0.4 mg/L in 2002, and TRC levels fell even lower in 2003 and 2004, with average TRC values of 0.26 mg/L for both of these years. The average TRC increased slightly in 2005 with a value of 0.30 mg/L. The average TRC also increased slightly in 2006 with an average concentration of 0.34 mg/L with a range similar to that seen in 2005. The average fecal coliform monthly average rose from 39 FC MPN/100 mL in 2001 to a high of 325 FC MPN/100 mL in 2004, and in 2006 has dropped back even further to 44 FC MPN/100 mL. As noted above, there were the two exceedances in 2006 of stated permit limits for fecal coliform that were reported to EPA with the July and October 2006 DMRs.

Quarterly WET testing was conducted on 24-hr flow composite effluent samples during all four quarters of calendar year 2006. Echinoderm fertilization tests were performed during the first, second, and third quarters of 2006. Use of this test during the first three quarters was based on the screening test results from the third quarter of 2005, which had determined the sea urchin to be the most sensitive species tested. Annual three-species re-screening for the most sensitive species in 2006 was performed during the fourth quarter, and the sea urchin was again found to be the most sensitive species. Although a toxic response was seen from the effluent during the 1<sup>st</sup>, 3<sup>rd</sup>, and 4<sup>th</sup> quarter WET testing, all results were found to be acceptable and within the Permit specified limit of TUC < 143 and required no additional testing.

***In summary, effluent chemistry monitoring indicated that with the exception of fecal coliform and BOD<sub>5</sub>, effluent concentrations of toxic pollutants and pesticides, metals and cyanide, and conventional parameters were much lower than their applicable permit limits or their MAECs. For fecal coliform, the criterion of not more than 10 % of the samples exceed 2600 FC MPN/100 mL was not met during two months of 2006. For BOD<sub>5</sub> the percent removal was found to be lower than the regulatory requirement during one month of 2006. All toxic pollutants and pesticides concentrations including metals and cyanide were lower than or within the range of those detected at secondary treatment plants from across the nation.***

### 5.1.2 Sludge Monitoring

The current permit requires sludge monitoring twice per year, once each during the dry and wet conditions in summer as part of the toxic pollutant/pretreatment monitoring. There are no Part 503 monitoring requirements included in the permit, but sludge monitoring is required because the Part 503 regulations are self-implementing as described in Section 2.1.5. Part 503 monitoring of sludge at Asplund WTCF has been included in this report (Table 13) and will also be reported separately to EPA as required by the regulations by 19 February 2007.

While limits for levels of toxic pollutants and pesticides in sludge are not part of the current permit, comparisons can be made for these data based on other treatment facilities' monitoring results and to the site specific allowable limits for metals that were determined for the facility. In all cases, sludge metals were found to be substantially lower than the site specific allowable limits (Table 13). Again, data indicate that concentrations of toxic pollutants and pesticides in Anchorage sludge are generally lower than "typical" concentrations seen at other treatment facilities (Table 26). As were the last two years, arsenic concentrations seen in sludge were less than those typically seen, with an average of 3.8 µg/g from the Part 503 monitoring compared to a typical concentration of 4.6 µg/g. Arsenic during the October and December monitoring were both higher than the typical concentration at 5.94 and 5.08 µg/g, respectively, although both of these analyses were performed by an outside laboratory due to construction activities at the WPCF. The average mercury concentration measured during the Part 503 sampling was 0.86 µg/g, below the typical concentration of 1.49 µg/g. Mercury concentrations measured during the toxic pollutant sampling were also less than typical concentrations with concentrations of 1.10 and 0.91 µg/g during June and August, respectively. The other Part 503 metals tested (beryllium, cadmium, chromium, lead, and nickel) also fell below typical concentrations.

Other metals that were monitored but not a requirement of the Part 503 regulations were copper, selenium, and zinc. Copper and zinc concentrations were both below typical concentrations. The selenium values reported for the June and August 2006 samplings event were 3.6 and 4.5 µg/g, respectively, compared to the typical concentration of 1.11 µg/g and a 95<sup>th</sup> percentile concentration of 4.85 µg/g.

Table 27 provides an overview of historical sludge data for total recoverable metals. In general, year 2005 data indicated similar concentrations of arsenic, cadmium, chromium, lead mercury, and nickel compared to historical data over the last few years. Beryllium values appeared to be similar to historical values, with concentrations below both the typical and the 95<sup>th</sup> percentile concentrations (Table 26).

## 5.2 WATER QUALITY MONITORING

### 5.2.1 Plume Dispersion Sampling

To test the hypothesis that the water quality at the ZID boundary was not degraded with respect to the water quality at the nearfield and control stations, the non-parametric Kruskal-Wallis Test (Zar, 1984) was employed which determined whether significant differences occurred within the sample group. If significant differences were observed, Dunn's test, a test that performs pairwise tests of significance ( $\alpha = 0.05$ ), was employed (Dunn, 1964). The results of these tests for the June survey period as a function of water quality parameters are presented in Table 26. Non-detect values were replaced with the detection limit value for statistical testing.

**Table 26. Comparison Between Sludge Analysis Results for Anchorage and Typical and Worse Case Concentrations Used by EPA in Developing Median or Mean Environmental Profiles<sup>a</sup>. All concentrations are in µg/g dry weight.**

Pollutant	2006 Anchorage Values			Typical Concentration	95 <sup>th</sup> Percentile "Worse Case"
	June <sup>b</sup>	August <sup>b</sup>	2006 AVG <sup>c</sup>		
Aldrin/Dieldrin	0.079 / 0.0089 J, COL	ND / ND (0.054)	---	0.07	0.81
Arsenic	4.2	4.4	3.8	4.6	20.77
Benzene	0.005 J	0.020 J	---	0.326	6.58
Benzo(a)anthracene	ND(42)	ND(210)	---	0.68	4.8
Benzo(a)pyrene	ND(42)	ND(210)	---	0.14	1.94
Beryllium	ND (0.35)	ND (0.79)	0.06	0.313	1.168
Bis(2-ethylhexyl)phthalate	47	92 J	---	94.28	459.25
Cadmium	1.7	1.6	2	8.15	88.13
Carbon Tetrachloride	ND(0.016)	ND(0.079)	---	0.048	8.006
Chlordane (α,γ)	ND(0.042)/0.042 J, COL	ND(0.054)/ ND(0.054)	---	3.2	12
Chloroform	0.0038 J	0.012 J	---	0.049	1.177
Chromium	16	25	17	230.1	1499.7
Copper	240	230	---	409.6	1427
Cyanide	0.36 / 0.30	0.22/0.24	---	476.2	2686.6
DDT/DDE/DDD	ND(0.051)/0.019 J,COL/ ND(0.051)	ND(0.054)/ ND(0.054)/ ND(0.054)	---	0.28	0.93
3,3-Dichlorobenzidine	ND(84)	ND(420)	---	1.64	2.29
Methylene chloride	ND (0.016)	ND (0.016)	---	1.6	19
Endrin	ND (0.051)	ND(0.054)	---	0.14	0.17
Hexachlorobenzene	ND(42)	ND(210)	---	0.38	2.18
Hexachlorobutadiene	ND(42)	ND(210)	---	0.3	8
Lead	23	25	26	248.2	1070.8
gamma-BHC (Lindane)	0.018 J, COL	ND(0.054)	---	0.11	0.22
Malathion	ND(0.045)	ND(0.960)	---	0.045	0.63
Mercury	1.1 / 1.1	0.91 / 0.90	0.86	1.49	5.84
Nickel	14	14	15	44.7	662.7
PCBs	ND(0.140)	ND(0.150)	---	0.99	2.9
Pentachlorophenol	ND(200)	ND(1000)	---	0.0865	30.434
Phenanthrene	ND(42)	ND(210)	---	3.71	20.69
Phenol	ND(42)	ND (210)	---	4.884	82.06
Selenium	3.6	4.5	---	1.11	4.848
Tetrachloroethene	0.100	0.430	---	0.181	13.707
Trichloroethene	0.0023 J	0.016 J	---	0.46	17.85
2,4,6-Trichlorophenol	ND(42)	ND(210)	---	2.3	4.6
Vinyl Chloride	ND(0.016)	ND(0.079)	---	0.43	311.942
Zinc	540	570	---	677.6	4580

<sup>a</sup> Source: EPA 1985c. *Summary of Environmental Profiles and Hazard Indices for Constituents of Municipal Sludge: Methods and Results*. Office of Water Regulations and Standards, Appendix F.

<sup>b</sup> Data from NPDES 2006 toxic pollutant and pesticide monitoring

<sup>c</sup> Average from 2006 Part 503 sludge monitoring results

--- Not monitored in-plant for Part 503

J Estimated value

ND ( ) Not detected (detection limit)

NT Not Tested

**Table 27. Historical Discharge Monitoring Data (1986 - Present) for Metals in Sludge.**

Year	Arsenic	Beryllium*	Cadmium	Chromium (Total)	Lead	Mercury	Nickel
<b>1986-2000 Min</b>	1.7	<0.02	0.7	3.38	24	<0.1	<8
<b>1986-2000 Max</b>	151	0.22	10.0	55	468	7.3	42
2001 Avg	3.1	0.15	2.6	17	43	1.1	17
2001 Min	2.4	0.12	2.0	12	26	0.5	15
2001 Max	4.0	0.21	3.4	22	91	2.0	19
2002 Avg	2.7	0.13	2.6	20	32	1.2	16
2002 Min	2.1	0.08	2.0	16	22	0.8	10
2002 Max	3.3	0.21	3.6	25	50	3.2	22
2003 Avg	2.2	0.15	1.9	14	29	1.3	20
2003 Min	1.7	0.07	0.7	8	19	0.9	7
2003 Max	2.9	0.23	2.7	19	47	2.1	53
2004 Avg	3.0	0.14	2.0	16	25	1.3	14
2004 Min	2.5	0.11	1.3	11	20	0.7	9
2004 Max	3.8	0.18	3.0	21	30	2.1	17
2005 Avg	2.4	0.21	2.0	14	25	1.5	16
2005 Min	1.8	0.13	1.69	12	10	ND (<0.021)	11
2005 Max	2.7	0.37	3.0	19	33	3.1	20
2006 Avg	3.8	0.06	2	17	26	0.86	15
2006 Min	1.9	ND	1.23	13	18.2	0.390	11.9
2006 Max	5.94	0.15	3	25	39.3	1.70	19

\* Beryllium testing began in 1993

Data from the receiving water survey showed statistically significant differences between outfall and control stations for both salinity and pH for all depths. The salinity difference was the result of the control stations being slightly less saline; however, even though significant differences were found, these differences were very small. In the past the control stations have often been found to be less saline as a result of increased river influence on the north side of Knik Arm. Temperature was found to be significantly different between the outfall and control stations for only the surface and mid-depth. Differences for TRC were seen between the within ZID stations and the other outfall and control station groupings. No significant differences were seen for dissolved oxygen, turbidity, color, or fecal coliform.

All pH values fell within the AWQS of 6.5 - 8.5 and values did not vary more than 0.2 pH units that would be attributed to the outfall, as required by the AWQS. For color, all concentrations were  $\leq 10$  units as compared to the AWQS of 15 for color, including samples from both the outfall and control stations. High color readings that were seen in 2004 and 2005 are believed to be due to the naturally high suspended sediment levels in the samples from Knik Arm that were not completely removed from the samples prior to analysis.



**Table 28. 2006 Station Group Differences at the 5 Percent Significance Level ( $p \leq 0.05$ ) as determined by the Nonparametric Kruskal-Wallis (ANOVA) and Dunn's (ad hoc multiple comparison) Statistical Analysis Tests.**

Water Quality Parameter	Water Column Depth		
	Surface	Middle	Bottom
<u>Conventional Analyses*</u>			
Temperature	<u>1 2 3</u> vs. <u>4</u>	<u>1 2 3</u> vs. <u>1 4</u>	NS
Salinity	<u>1 2 3</u> vs. <u>4</u>	<u>1 2 3</u> vs. <u>4</u>	<u>1 2 3</u> vs. <u>4</u>
Dissolved Oxygen	NS	NS	NS
pH	<u>1 2 3</u> vs. <u>4</u>	<u>1 2 3</u> vs. <u>4</u>	<u>1 2 3</u> vs. <u>4</u>
Turbidity	NS	NS	NS
Color Units	NS	----	----
Fecal Coliform	NS (no variance)	----	----
Total Residual Chlorine	<u>1</u> vs. <u>2 3 4</u>	----	----
<u>Metal and Hydrocarbon Analyses**</u>			
Arsenic	NS <sup>D</sup> , NS <sup>TR</sup>	----	----
Cadmium	NS <sup>D</sup> , <b>SIG</b> <sup>TR</sup>	----	----
Chromium	NS <sup>D</sup> , NS <sup>TR</sup>	----	----
Copper	NS <sup>D</sup> , <b>SIG</b> <sup>TR</sup>	----	----
Mercury	NS <sup>D</sup> , NS <sup>TR</sup>	----	----
Nickel	NS <sup>D</sup> , NS <sup>TR</sup>	----	----
Lead	NS <sup>D</sup> , NS <sup>TR</sup>	----	----
Silver	NS <sup>D</sup> , NS <sup>TR</sup>	----	----
Zinc	NS <sup>D</sup> , NS <sup>TR</sup>	----	----
Cyanide	NS	----	----
Total Suspended Solids	<b>SIG</b>	----	----
Total Aromatic Hydrocarbons (BETX)	NS	----	----
Total Aqueous Hydrocarbons (TAqH)	NS	----	----

\* Tests were performed on four Station Groups (Group 1: Within-ZID Sites; Group 2: ZID Boundary Sites; Group 3: Nearfield Sites; and Group 4: Control Sites). Bolded Groups signify **SIG** result. Underlined Groups are not significantly different from each other (Dunn's Test result,  $p > 0.05$ ).

\*\* Tests performed on stations located between the outfall (Drogue F1 sites) and the control (Drogue C1 sites).

---- Not Applicable (surface samples only)

NS Not Significant K-W Test Result ( $p > 0.05$ )

**SIG** Significant K-W Test Result ( $p \leq 0.05$ )

<sup>D</sup> Dissolved

<sup>TR</sup> Total Recoverable

In addition to the standard water quality sampling, concentrations of total aromatic hydrocarbons as BETX and TAqH were measured at the surface at six stations (three at the flood tide control site and three at the flood tide outfall site, along the first drogue track). No statistically significant differences in BTEX or TAqH concentrations were detected between the control and outfall stations. There were no BTEX concentrations above MDLs seen at the Control Stations. Two ZID Stations, including an estimated value from a field duplicate, sample had BTEX values slightly above the MDL however, both these values were well below, the State of Alaska water quality standard of 10 µg/L. TAqH concentrations were seen at all six stations but with a maximum of 3.33 µg/L, were significantly less than the AWQS of 15 µg/L. In addition, visual comparison of TPAH concentrations did not indicate that levels were elevated at the outfall, although this has sometimes been seen in the past. All TPAH levels were relatively low.

Total suspended solids, cyanide, and total recoverable and dissolved metals samples collected at the outfall and control sites were also subject to statistical testing. Significant differences were noted only for concentrations of TSS and dissolved cadmium and copper, which were elevated at the outfall stations as compared to the control stations. Within the outfall stations, concentrations for most of the dissolved metals were highest at Station F1-2 (ZID boundary), with chromium and nickel being highest at Station F1-1 (within-ZID), and zinc being highest at the near-field Station (F1-3). It is possible that this could be due to the influence of the outfall discharge, although the TSS concentration was also the highest at Station F1-2. Except for cyanide, all of the total metal concentrations were found to be highest at the near-field site, Station F1-3. Cyanide was found to be highest at Station F1-2 on the ZID boundary. Again, apparent differences between the outfall and control stations levels were not statistically significant for any of the total metals although statistically significant differences were seen for TSS.

A comparison of the water quality data listed in Table 15 with the marine receiving water quality for the State of Alaska (Table 21 and Table 29) indicates that none of the parameters listed in Table 15 exceeded the State's standards. As noted in Section 3.2.1, with the exception of two stations (F1-1 and F2-1), all of the TRC concentrations were below the PQL of 0.010 mg/L. It should be noted that the lowest achievable method detection limit for TRC analysis in seawater (0.010 mg/L) is higher than the State-specified limits of 0.002 mg/L for salmonid fish and 0.010

mg/L for other marine species. As previously noted, although the amperometric method that was used is the preferred method due to less interference, all TRC methods are subject to positive interferences in estuarine or marine waters. In past years, some of the highest TRC levels were seen at the control stations.

The State's receiving water quality standard for the "growth and propagation of fish, shellfish, aquatic life, and wildlife including seabirds, waterfowl, and furbearers" is 15 µg/L for TAqH and 10 µg/L for total aromatic hydrocarbons. As seen in Table 17, these standards were not exceeded during the receiving water sampling. For all control stations (C1-1, C1-2 and C1-3) BETX was not detected, with method detection limits well below the state standards. Two outfall stations (F1-1 and F1-2) had BTEX values well below the state standards while at the third outfall station (F1-3) BTEX was not detected. In addition, for "contact recreation", the AWQS for hydrocarbons is as follows: "Shall not cause a film, sheen, or discoloration on the

**Table 29. State of Alaska Water Quality Standards for Receiving Water.**

Parameter	Most Restrictive Marine Water Quality Standards								
Fecal Coliform	Based on a 5-tube decimal dilution test the fecal coliform median MPN shall not exceed 14 FC/100 mL (harvesting for consumption of raw shellfish); a geometric mean of 20 FC/100 mL (for aquaculture of products not normally cooked and seafood processing); and not more than ten percent (10%) of the samples shall exceed 40 FC/100 mL (aquaculture of products not normally cooked and seafood processing).								
Dissolved Oxygen	Dissolved oxygen concentrations in estuaries and tidal tributaries shall not be less than 5.0 mg/L except where natural conditions cause this value to be depressed.								
pH	pH shall not be less than 6.5 or greater than 8.5, and shall not vary more than 0.2 pH unit from natural condition.								
Turbidity	Turbidity may not exceed the natural condition.								
Temperature	Temperature shall not cause the weekly average temperature to increase more than 1° C. The maximum rate of change shall not exceed 0.5° C per hour. Normal daily temperature cycles shall not be altered in amplitude or frequency.								
Salinity	<p>Maximum allowable variation above natural salinity:</p> <table> <tr> <th>Natural Salinity (‰)</th><th>Man-induced Salinity (‰)</th></tr> <tr> <td>0 to 3.5</td><td>1</td></tr> <tr> <td>3.5 to 13.5</td><td>2</td></tr> <tr> <td>13.5 to 35.0</td><td>4</td></tr> </table>	Natural Salinity (‰)	Man-induced Salinity (‰)	0 to 3.5	1	3.5 to 13.5	2	13.5 to 35.0	4
Natural Salinity (‰)	Man-induced Salinity (‰)								
0 to 3.5	1								
3.5 to 13.5	2								
13.5 to 35.0	4								
Sediment	No measurable increase in concentrations above natural conditions.								
Color	Color shall not exceed 15 color units.								
Petroleum Hydrocarbons, Oils and Grease	Total aqueous hydrocarbons (TAqH) in the water column shall not exceed 15 µg/L. Total aromatic hydrocarbons (TAH) in the water column shall not exceed 10 µg/L. Shall not cause a film, sheen, or discoloration on the surface or floor of the water body or adjoining shorelines. Surface waters shall be virtually free from floating oils.								
Total Residual Chlorine	Concentrations shall not exceed 2.0 µg/L for salmonid fish or 10.0 µg/L for other organisms.								
Toxic and Other Deleterious Substances	See Table 21.								

surface or floor of the water body or adjoining shorelines. Surface waters shall be virtually free from floating oils." No film, sheen, or discoloration was observed during the receiving water sampling program in 2006.

All the dissolved metals tested in receiving water (Table 16) as part of this program met the AWQS as shown in Table 21, even at Station F1-1 within the ZID. These included: arsenic, cadmium, chromium, copper, lead, mercury, nickel, silver, and zinc. Testing of antimony, beryllium, selenium, and thallium in receiving water is not required by the permit and was not performed. Previous years of monitoring showed exceedances of water quality criteria for total recoverable metals that were due to the specified test methods in conjunction with high amounts of suspended particulates in Cook Inlet. Since the adoption of the more-appropriate SSWQC for dissolved metals in May 1999, the receiving waters of Cook Inlet near the Asplund WPCF discharge have been in compliance with the AWQS.

All cyanide samples collected during the receiving water sampling were below the State-specified criteria of 1 µg/L for marine aquatic life. The highest cyanide concentration was seen at Station F1-2 (ZID Boundary) with a reported value of 0.39 µg/L. The cyanide concentration in the effluent, that was measured as part of the receiving water sampling, was reported at a concentration of 0.39 µg/L, well below the MAEC of 181 µg/L.

*In summation, statistical analyses of the 2006 receiving water quality data indicated that water quality outside the ZID was not degraded with respect to control stations for any parameters. Differences that were noted in some parameters such as salinity, temperature, and pH were unlikely to be influenced by the Asplund WPCF outfall. All AWQS were met for the Asplund WPCF receiving water quality program. Although some parameters appeared to be elevated at the outfall stations as compared to control stations, statistically significant increases at the outfall stations were seen only for TSS and dissolved cadmium and copper, and all dissolved metals concentrations, including cadmium and copper, were well below the AWQS. No statistically significant differences were seen for total metals, BETX or TAqH hydrocarbon concentrations between the outfall and control locations and all hydrocarbon concentrations were below AWQS.*

### **5.2.2 Fecal Coliform Bacteria**

The ADEC has indicated that one of their primary concerns is bacterial contamination of the shoreline by the Asplund discharge, indicated by fecal coliform bacteria concentrations. Because the Knik Arm's water uses have not been classified, regulations provide that the most restrictive standard must apply. State marine water quality standards for contact recreation require that the geometric mean fecal coliform concentration taken within a 30-day period not exceed 100 FC MPN/100 mL and that not more than one sample, or more than 10 % of the samples if there are more than 10, exceed 200 FC MPN/100 mL. Criteria for secondary recreation and for industrial water supply require that the mean fecal coliform concentration not exceed 200 FC MPN/100 mL and that not more than 10 % of the samples exceed 400 FC MPN/100 mL. State marine water quality criteria for the harvesting for consumption of raw mollusks and other raw aquatic life require that, based on a 5-tube decimal dilution test, the median shall not exceed 14 FC MPN/100 mL, and that not more than 10 % of the samples shall exceed 43 FC MPN/100 mL. For seafood processing water supply for products not normally cooked, criteria are that the geometric mean may not exceed 20 FC MPN/100 mL, and not more than 10 % of the samples shall exceed 40 FC MPN/100 mL. For seafood processing water supply for products normally

cooked, criteria are that the geometric mean may not exceed 200 FC MPN/100 mL, and not more than 10 % of the samples shall exceed 400 FC MPN/100 mL. For aquaculture water supply, criteria are that the geometric mean may not exceed 20 FC MPN/100 mL and not more than 10 % of the samples may exceed 40 FC MPN/100 mL.

Since the harvesting of shellfish and other raw aquatic life is not performed in these waters, and there is no aquaculture or seafood processing, it seems that the criteria for secondary recreation is most applicable; however, these criteria are not the most restrictive. Therefore, the most restrictive criteria used were that the median shall not exceed 14 FC MPN/100 mL (consumption of raw shellfish and other aquatic life), the geometric mean shall not exceed 20 FC MPN/100 mL (seafood processing and aquaculture for raw consumption), and not more than 10 % shall exceed 40 FC MPN/100 mL (seafood processing and aquaculture for raw consumption; Table 29).

Statistical tests indicated that fecal coliform concentrations were not significantly different between the within-ZID, ZID boundary, and the nearfield outfall station groups as compared to the control stations (refer to Table 28). Fecal coliform concentrations were very low again this year, and values ranged from <2 to 2 FC MPN/100 mL at the outfall stations (including the ZID stations) with the same range of <2 to 2 FC MPN/100 mL at the control stations. The median at the control stations was 2 FC MPN/100 mL, as was the median at the all outfall stations (stations both within and outside the ZID) for both ebb and flood tides, well within the 14 FC MPN/100 mL criterion. The control site had a geometric mean of 2.0 FC MPN/100 mL, while that at the all the outfall stations (inside and outside the ZID) was also 2.0 FC MPN/100 mL, both well below the criterion of 20 FC MPN/100 mL. No measurements (0 %) at the outfall stations either within or outside the ZID exceeded 40 FC MPN/100 mL, compared to the criteria of not more than 10 % of the measurements may exceed 40 FC MPN/100 mL. No samples collected at the control stations exceeded this criterion. The highest fecal coliform concentration (2 FC MPN/100 mL) was seen this year at a number of outfall and control stations.

Relatively low fecal coliform bacterial concentrations were seen in two of the three creeks sampled as compared to historical data, although all creek concentrations were still higher than with either the receiving water or intertidal samples that were collected. The two replicate fecal coliform concentrations measured in Fish Creek were 110 and 220 FC MPN/100 mL. Replicate concentrations measured in Ship Creek were lower at <2 and 4 FC MPN/100 mL, while those at Chester Creek were 7 and 13 FC MPN/100 mL.

The range of fecal coliform concentrations for all intertidal samples collected during 2006 was quite low at <2 to 4 FC MPN/100 mL, with a median of 2 FC MPN/100 mL and a geometric mean of 2.2 FC MPN/100 mL. These values met the most restrictive water quality criterion of a median of 14 FC MPN/100 mL and a geometric mean of 20 FC MPN/100 mL. The highest coliform concentrations were seen at Stations IT-4, 250 m east of the outfall and IT-C, the control site near Point MacKenzie. Due to the very low values encountered in 2006 throughout the study area, it is clear that the outfall was not affecting the intertidal zone during this sampling event. The criterion of not more than 10 % of the samples exceeding 40 FC 100/mL was met, as none of the intertidal measurements exceeded this value. Although not seen in this year's data, in the past, the slightly elevated fecal concentrations seen intertidally were attributed to heavy waterfowl use of the area. Fecal coliform concentrations in the effluent samples collected in conjunction with the receiving water, intertidal sampling, and stream sampling were considerably higher at 500 and >1600 FC MPN/100 mL for the two replicates. These values

were higher than many of the average monthly values reported, which ranged from 19 to 484 FC MPN/100 mL (Table 8).

*In summary, fecal coliform concentrations in 2006 were found be very low in both the receiving water and intertidal areas. No statistically significant differences were seen between station groupings for the ZID, ZID-boundary, or nearfield stations as compared to the control location. Two of the three area creeks were also found to be low in fecal coliform concentrations in 2006. Fecal coliform samples collected during the receiving water sampling program met all AWQS criteria, including all outfall stations both within and outside the ZID. All fecal coliform samples collected from intertidal areas also met all water quality criteria.*

## 6.0 CONCLUSIONS

The following conclusions were based on results from this year of monitoring as compared to the current NPDES permit:

- The influent, effluent, and sludge monitoring has shown that, with the exception of only fecal coliform and BOD<sub>5</sub>, the Asplund WPCF met the NPDES permit requirements and complied with State of Alaska water quality standards. MOA's self-monitoring of TRC, pH, and TSS showed compliance with all 2006 permit effluent limitations.
- For fecal coliform, the maximum geometric mean of 850 FC MPN/100 mL was never exceeded in 2006. Fecal coliform exceeded the monthly criteria "that not more than 10 % of the effluent samples shall exceed 2600 FC MPN/100 mL during any month" in July and October 2006.
- MOA's self-monitoring of pH and TSS showed compliance with regulatory and permit effluent limitations. TSS and BOD<sub>5</sub> were well within the daily, weekly, and monthly criteria for the entire reporting period. Average monthly removals for BOD<sub>5</sub> and TSS of greater than 30 % are required by the amendment to the Clean Water Act (40 CFR Part 125; Final Rule, 8/9/94). The percent removal rate for both TSS (77 %) and BOD<sub>5</sub> (34 %) exceeded the 30 percent (%) limit on an annual basis, however on a monthly basis, BOD<sub>5</sub> was below the 30 % guideline in March at 28 %.
- Total aqueous hydrocarbon and total aromatic hydrocarbon concentrations in the effluent were below their respective MAECs, as was total ammonia.
- Cyanide and metals concentrations in the effluent never exceeded their MAECs during any of the 2006 sampling events.
- Concentrations of toxic pollutants and pesticides, including metals and cyanide, in influent and effluent were generally within the established range or lower than values from a national study of secondary treatment plants. All toxic pollutant sludge concentrations were within the established range or lower than values from a national study of secondary treatment plants, with all metals falling at or below typical concentrations and well below 95<sup>th</sup> percentile worst case values.
- Whole effluent toxicity testing conducted quarterly met the permit limitations for chronic toxicity for all species and for sampling events in 2006.
- To test the hypothesis that the water quality at the ZID boundary was not degraded with respect to the water quality at the nearfield and control stations, statistical comparisons were employed. Conventional parameters such as salinity, temperature, TSS, and pH did show statistically significant differences between stations, but these were not ascribed to the outfall. Rather, these have historically been seen when comparing the Point Woronzof region to the slightly different water mass properties across Knik Arm at the control site due to river inputs. No significant differences were seen for dissolved oxygen, turbidity, fecal coliform, or color.

- Fecal coliform concentrations in offshore receiving water samples were found to be very low at all stations. State-specified criteria of a median of 14 FC MPN/100 mL, a geometric mean of 20 FC MPN/100 mL, and of not more than 10 % of the samples exceeding 40 FC MPN/100 mL were met at all receiving water locations. All fecal coliform samples collected from intertidal areas also met water quality criteria.
- Supplemental receiving water quality samples obtained as part of the plume dispersion monitoring indicated that dissolved metals were all below the State site-specific water quality standards. None of the dissolved metals exceeded the site-specific standards at the diffuser or at any other location. Significant differences between the outfall and control stations were seen only for dissolved cadmium and copper which was slightly elevated at the outfall. These increased dissolved metals concentrations as compared to controls may be attributed to the outfall, but water quality standards were still met. Total recoverable metals were elevated compared to the dissolved, as expected, and this was attributed to high suspended sediment loads.
- All cyanide concentrations in the receiving waters were below the receiving water quality criterion limit of 1.0 µg/L and no statistically significant differences were detected between concentrations at the control and outfall stations.
- Supplemental receiving water samples also demonstrated that total aromatic hydrocarbons and total aqueous hydrocarbons met the State's water quality standard at all locations. No statistically significant differences were detected between concentrations at the control and outfall stations for either total aromatic hydrocarbons or total aqueous hydrocarbons.
- Turbidity met the State water quality criteria at all stations. TRC concentrations were below 0.010 mg/L (10 µg/L) at all stations, except two that were located within the ZID, as compared to the AWQS of 2.0 µg/L for salmonid fish and 10 µg/L for other marine organisms. As the lowest level detection limit that is achievable for TRC in seawater is higher than the State's most restrictive standard, it cannot be determined if this standard was met. Color was found to meet State water quality criteria for all samples and locations.

## CONCLUSIONS

Results from this year of the monitoring program confirm previous studies, data in the 301(h) waiver application, and the decision by the EPA to reissue the permit. The Asplund WPCF is operating within regulatory requirements with few exceptions and is showing no significant impacts to the marine environment.



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